U. S. Department of Agriculture.
Abstract No. 1.

WORLD'S DAIRY CONGRESS, 1923.

ABSTRACT.

PRESIDENTIAL ADDRESS.

By H. E. VAN NORMAN, President, World's Dairy Congress Association, Inc.

American scientists and leaders heartily welcome the representatives of the dairy countries of the world. This congress is the outgrowth of a long-existing wish to entertain in this country the men and women of other lands who are contributing to the progress of this great industry.

This congress was undertaken before the signing of all world-war treaties and under conditions which prompted the dairy leaders of America to take the initiative. With the reestablishment of active work of the International Dairy Federation we were happy to secure its cooperation. This congress is not legislative in character. It has no authority to commit its delegates or the countries they represent to any particular policy or course of action.

It has been made possible by the financial support of the Government and the dairy industry. It will serve its adherents if it brings into wider use the best fruits of scientific research and if it increases the appreciation of the part which fundamental scientific research contributes to economic progress. If it shall thus secure an added support for such research it will doubly serve. Not of the least importance is the cultivation of that personal and international acquaintance which makes for understanding and for world peace.

We of this country are indebted to Europe for our breeds of dairy cattle, early feeding standards, and our elementary knowledge of dairy chemistry and bacteriology, the pasteurization process, the use of pure culture, the centrifugal separator, leadership in standardization of export dairy products and early cooperative organizations.

We have materially developed these gifts and have also made our contributions, such as the use of the attractive 1-pound rectangular butter package for retail trade, the high-grade milk supply for cities, the system of supervision of production and the perfection of commercial pasteurization equipment and methods, application of mechanical refrigeration, the development of labor-saving machinery, the ice cream business, the perfection of milk condensing and milk powder manufacture, State supervision of advance registry of pure-

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bred cows, and the developing of certified milk. Our vast areas of scattered farms, with relatively small herds, have brought about our so-called centralized creameries, also the great system of cooperative creameries.

This congress is a recognition of the world character of this industry, of the interrelationship of all of the countries engaged in dairying, and of the fact that seasonal, climatic, economic, and political changes in any country rapidly affect the prosperity of the dairy industry in other countries. Successful leadership seeks increasing familiarity with these world forces.

Six great nations are today aggressively encouraging increased dairy production. This necessitates increased consumption. The revelations of science and the accumulated data of welfare agencies show immense, untouched markets in every country in that portion of its growing and mature population which, through ignorance and in spite of wealth or poverty, is underfed because of unwise choice of foods and insufficient use of milk. Wider dissemination of these facts is a contribution to human health and to the economic prosperity of the industry.

New problems confronting the industry are, the relation of mineral matter to the nutrition of dairy animals, the control of costly diseases, the increased use of mechanical equipment, the influence of larger container units, the application of mechanical refrigeration to geographical distribution, and the growth of cooperative organizations.

The part which some 1,300 national and State dairy organizations play in the rapid dissemination of knowledge and stimulation of improvement in our American industry prompts the suggestion of the need of greater coordination in our own industry, a closer articulation with the world's dairy organizations, and the hope that future international meetings, while accentuating the service of science, will give greater recognition to the part which the organized industry plays in the application of science to commerce, and finally the wider cultivation of society's appreciation of its dependency on a successful dairy industry for lowering the human death rate and increasing the physical efficiency of men and women.

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U. S. Department of Agriculture.
Abstract No. 6.

WORLD'S DAIRY CONGRESS, 1923.

ABSTRACT.

INTERNATIONAL TRADE IN DAIRY PRODUCTS—SIGNIFICANT TRENDS OF SUPPLY, DEMAND, AND PRICE.

By H. C. TAYLOR, Chief, Bureau of Agricultural Economics, U. S. Department of Agriculture, Washington, D. C.

International trade in dairy products is steadily increasing in volume and the prices at which they are marketed are increasingly influenced by world conditions. Recent economic developments and certain outstanding changes in the dairy industry for the world are affecting directly or indirectly all markets for dairy products. Eventually this must further influence the development of the dairy industry in any particular country. Dairy production has now become thoroughly established in both the Northern and Southern Hemispheres; as a consequence, mutually advantageous seasonal trade between countries becomes a possibility, to replace, to some degree, the system of seasonal storage that grows out of a local or national economy.

More than 20 billion pounds of milk were required during the past year to produce the butter, cheese, and preserved milk that entered into the international trade of the world. Fifty years ago the total international trade in dairy products amounted to about one-fourth its present size and consisted of shipments to England of butter from Denmark and France, of cheese from Holland and Switzerland, of cheese from the United States, and of butter and cheese from Canada. In the past 25 years, dairying has been developed in New Zealand, Australia, and Argentina, and these countries have come in to prominence as exporting countries. Denmark, Holland, and Switzerland have become increasingly important. Russia attained an important place in exportation of butter just prior to the World War but is now entirely out of international trade and Canada has become a lesser factor as an exporter of cheese but holds an important place in butter exports. In the United States imports of cheese practically balance the exports of butter, condensed and evaporated milk, and other dairy products.

The outstanding points of significance are the development of dairying in certain countries of the Southern Hemisphere, the

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attendant prominent place obtained by these countries in the world's international trade, and the general decline of Canada and the United States as exporting countries.

Improvements in transportation have affected both quantity and quality of shipments. Refrigeration has made possible the transportation of fresh milk over great distances. The processes of preserving milk through partial or total dehydration have facilitated trade. By means of such treatment more than two billion pounds of milk were exported from the United States to Europe in 1919. Rapid growth of industrial centers in some countries has made them more dependent upon such international trade. The improvement in means of communication of market news has also promoted the exchange of products.

Trade in dairy products between nations may be checked or hindered by several factors, such as protective tariffs, successful imitation of foreign varieties, and effective systems of cold storage of domestic supplies to carry the surplus from seasons of heavy production to seasons of light production.

The price received for dairy products in any one country is not determined by conditions of supply and demand in that individual country alone, but by conditions of supply and demand the world over. Monthly prices of the best quality of butter in such countries as England, Denmark, Germany, and the United States for ten years preceding the last war show such close correlation as to establish the fact of a world market. That is to say, prices in any one market can not go far out of line with prevailing prices in any other market without inducing an adjustment that is profitable to both exporters and importers.

If the dairyman is thus related to a world economy, certain adjustments are forced upon him in whatever country he happens to carry on his enterprise. While milk as the original raw material of dairy products is essentially as good in one country as in another, competition in the matter of quality is limited to methods of manufacture and marketing. In the degree that economic pressure is brought to bear upon the dairymen of any country in the matter of marketing their dairy produce, increasing attention must be given to quality of products with production adapted to the existing demand.

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U. S. Department of Agriculture.
Abstract No. 7.

WORLD'S DAIRY CONGRESS, 1923.

ABSTRACT.

SOME ASPECTS OF THE INTERNATIONAL TRADE IN DAIRY PRODUCE.

By J. A. RUDDICK, Dairy Commissioner, Canada.

While there has been an international trade in dairy products within the Northern Hemisphere for many years, climatic and transportation conditions prevented any important movement of butter and cheese across the equator until about forty years ago. On January 17, 1881, the Steamship *Protos* landed 100 tons of Australian butter in London in good condition. This successful overseas transportation opened the Northern Hemisphere market to the products of New Zealand, Australia, Argentina, and South Africa.

The event of refrigeration improved the transportation of dairy products and refrigeration installed in storage houses extended the markets previously limited by time and distance.

During the last 10 years the Southern Hemisphere has made its greatest growth in exports of dairy products. While many markets feature in international trade, the United Kingdom, being the principal importing market, is the one considered.

Immediately preceding the war, the United Kingdom absorbed 67 per cent of the world's total exports as against 16 per cent by Germany. In the case of cheese, this was 50 per cent of the world's total exports; with France and Germany, about 9 per cent each.

Denmark has been the principal source of supply for the butter to the United Kingdom. The amount furnished by New Zealand and Australia has increased greatly, until at the present time New Zealand supplies nearly as much butter as Denmark.

In the case of cheese, in 1903 Canada supplied 68 per cent of the total cheese imported into the United Kingdom. By 1914, this had been reduced to 51 per cent and New Zealand increased to 28 per cent. In 1922, New Zealand took the lead, with 50 per cent.

New Zealand is now the largest exporter of cheese, and if the exports of butter show the same increase in 1923–24, as they did in 1922–23, they will then exceed those of Denmark, and New Zealand will be the largest exporter of both butter and cheese of any country in the world.

The development of dairying in the Southern Hemisphere can be shown by the proportion of total butter imports into the United

Kingdom. In 1903 they formed 7 per cent of the total importation. In 1914, the proportion was 21 per cent and in 1922–23, 44 per cent. In the case of cheese it is even more striking. In 1903, only 2 per cent of the imports came from below the equator; in 1914, 29 per cent; and in 1922–23, as much as 55 per cent.

The Southern Hemisphere has vast areas adapted to dairying which, as yet, have not been developed. Well-informed New Zealanders expect to see an increase of 100 per cent in dairy exports in the next ten years. In parts of Australia considerable further development is expected, expecially in Queensland. Even in such an unlikely place as the Fiji Islands, the creamery industry has already been established. There are millions of acres in the two main islands alone that are capable of supporting very nearly one cow to the acre the year round. Alfalfa may be cut ten or twelve times a year. All that is needed is initiative and enterprise.

Many parts of South Africa offer good opportunities, and Cheddar cheese from East Griqualand won first prize at the Royal Dairy Show in London last year. The possibilities of increased markets through greater consumption are enormous. A more widespread knowledge as to the value of milk and milk products in the diet and a higher appreciation of milk as a food rather than as a beverage will yet exert a very large influence on the quantity consumed.

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U. S. Department of Agriculture.
Abstract No. 8.

WORLD'S DAIRY CONGRESS, 1923.

ABSTRACT.

INTERNATIONAL TRADE IN DAIRY CATTLE.

By Dr. J. R. MOHLER, Chief of the Bureau of Animal Industry, United States Department of Agriculture, Washington, D. C.

This paper will deal with:

The relation of the live-stock industry to agriculture, referring especially to the dairy industry.

The desirability of nations exchanging live stock to improve breeds, with the view of producing dairy products and meats more economically and in larger quantities to meet growing demands with the increase of population.

The desirability of an exchange of information between nations at regular intervals in regard to:

(*a*) The diseases which exist in live-stock-producing countries, their prevalence, geographic location of infected areas, the efforts being made to control or eradicate them and the means employed.

(*b*) Prevalent internal and external parasites and the means employed to combat them.

(*c*) The facilities provided for research and investigations of animal diseases and the progress of the work.

(*d*) The live-stock sanitary organizations established in the various countries, their policies, personnel, changes, etc.

The dangers which attend the movement of live stock between different sections of a country and between countries and the need for protecting the live-stock industry against the dangers from moving animals for breeding or other purposes.

Live-stock sanitary control through veterinary organizations provided with authority and funds to function effectually in regulating the movement of animals and in promptly applying control and eradication measures in combating animal diseases as occasion requires.

The desirability of international regulations, which should be as uniform as possible, and suggestions in regard to fundamental provisions of regulations which would seem generally applicable to countries engaged in exporting and importing live stock for breeding and other purposes.

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Import regulations, especially to provide for the inspection, testing, and certification of animals imported into one country from another, including—

(*a*) A prohibition against importations from countries where destructive diseases exist which are of a highly contagious nature.

(*b*) Permits in advance from the proper officials of the countries to which animals are to be moved.

(*c*) Certificates of health from the proper officials of the exporting country.

(*d*) Affidavits of original owners of animals which are to be exported.

(*e*) Testing animals for diseases before importation, and official evidence of the tests.

(*f*) Sanitary requirements in connection with the transportation of animals.

(*g*) Quarantine of imported animals.

Export regulations, to provide for—

(*a*) The inspection, testing, and certification of animals for export, in compliance with the requirements of the country of destination.

(*b*) The handling of live stock entering a country but which is destined to another country.

The movement of animals within a country.

Handling outbreaks of disease.

Control measures, including quarantine.

Slaughter of infected and exposed animals in certain exotic diseases and remuneration of owners.

Cleaning and disinfection of infected premises, public stock yards, cars and boats.

Regulations governing importations and also local movements of hides, skins, and other animal by-products, hay, straw, forage, and similar material.

Measures for the control of the importation, production, and application of biological products intended for use in the treatment of domestic animals.

Laws and regulations of the United States.

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U. S. Department of Agriculture.
Abstract No. 11.

WORLD'S DAIRY CONGRESS, 1923.

ABSTRACT.

THE COLLECTION AND DISTRIBUTION OF MILK AND DAIRY PRODUCTS STATISTICS BY THE INTERNATIONAL INSTITUTE OF AGRICULTURE AT ROME.

Read by CESARE LONGOBARDI, Chief, Department of Statistics, International Institute of Agriculture, for L. G. MICHAELS, Official Delegate of that Institute, Rome, Italy.

1. To sum up, all countries, or at least all those in which the milk industry is specially important, ought to develop the organization of regular statistics of milk production. Where such statistics can not be established on the basis of direct annual censuses, they should at least include:

(*a*) A census taken at regular intervals, for example every 10 years, which should enumerate the actual quantities of milk produced and of dairy products.

(*b*) An annual valuation of milk production obtained indirectly on the basis of the actual number of milch cows and the annual estimate of yield per head.

Statistics similar to those recommended in the case of cow's milk should also be established for sheep's and goat's milk and their derivatives in countries where their production is of any considerable importance.

The International Institute of Agriculture would arrange for the collation and distribution of all the statistical information thus collected from the respective Governments.

2. This scheme can only be carried out gradually and as the result of special efforts by reason of the undeniable practical difficulties which have to be overcome. But the resultant advantages are so obvious and of such general interest that the institute is confident that it will be able to persuade the adherent Governments to put it into practice for their own countries and that it will also have the support of dairy farmers and the dairy trade.

By the terms of its constitution, the International Institute of Agriculture is charged with the duty of serving with the Governments as interpreter of the recommendations made by International Congresses.

The institute would therefore be glad if, in bringing the question of milk statistics before the next meeting of the general assembly in 1924, it might be in a position to state that it is at the same time giving expression to the recommendations which the congress will be formulating on the subject.

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U. S. Department of Agriculture.
Abstract No. 12.

WORLD'S DAIRY CONGRESS, 1923.

ABSTRACT.

DAIRY CATTLE ASSOCIATIONS AND THEIR WORK.

By Hon. F. O. LOWDEN, Formerly Governor of the State of Illinois, President, Holstein-Friesian Association of America, Oregon, Ill.

The various breeds of dairy cattle, like other farm animals, are the result of centuries of selection. In the course of time the natural result was a specialized animal, which was a vast improvement upon the earlier stock. In Great Britain have developed the Jersey, Guernsey, Ayrshire, Devon, Milking Shorthorn, and other less well-known breeds; in Holland, the Holstein-Friesian; and in Switzerland, the Brown Swiss.

During the early history of America, whatever cows happened to be at hand were brought over by the colonists. We were well along in the last century before we had anything upon our farms but the nondescript cow which was a product of the various early and careless importations.

It would have been possible, I assume, for America to have developed its own dairy breed, employing the same methods which had been employed successfully in older countries; but our people wisely decided to utilize the achievements of the European breeders of many centuries; and so to-day the chief dairy breeds in the United States are all derived from specialized breeds developed across the sea. Our indebtedness to the great breeders, especially of Great Britain, Holland, and Switzerland is immense, and one which we cheerfully acknowledge.

When importation of pure-bred cattle once began, it became necessary to form associations for preserving records of the cattle thus imported and their descendants. For this purpose herd books were established. Later, all of the dairy pure-breed associations established an advanced registry for recording production. This has come to be one of the most important of the activities of the pure-breed associations. It has developed a keen, but on the whole generous rivalry, both among owners of cows and between the different breeds. The advanced registry work has been a powerful factor in increasing the production of milk and butter fat.

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Advanced registration also serves to correct any excess of emphasis we may be likely to put on type. Wisely planned and carried out, it can be made a very valuable factor in helping to determine the ideal type of the dairy cow.

The most valuable work of the pure-breed associations, from the standpoint of the public, is the vast improvement they are bringing about for better and more efficient cows. The improved cow means decreased cost of milk, an indispensable food. All our people profit by this.

Several years ago, in Holland, in the house of a leading Holstein cattle breeder, I observed upon the wall a portrait of Thomas B. Wales, an early secretary of the Holstein-Friesian Association of America. The breeder stated that his father had sold more cattle to Mr. Wales than he had sold to any other man in all his career. How much more reason have we in America, who have profited vastly more, to hold in memory the names of these early pioneers of the dairy breeds. Their successors too are carrying on a fine and useful work.

It is the pure-breed dairy associations that are making the most persistent and effective fight against the scrub cow, which still remains in overwhelming numbers upon the farms of America. Calf clubs are being organized all over the country, composed of boys and girls who become owners of one or more pure-bred or high-grade calves. Through the activities of these calf clubs the dairy cattle of the community begin to improve. In the second place, the club tends to attach the boy or girl to the farm. The successful breeders and farmers of coming years will be those now enrolled as members of boys' and girls' clubs.

The pure-breed associations are waging a continual fight against the scrub bull. Recently in one State a most effective drive has been made by the united forces of the pure-breed dairy associations and the pure-breed beef cattle associations. This campaign will add to the wealth of the State and the well-being of her citizens. It is possible by this method to secure the cooperation of the business interests of the community. In an agricultural community all are interested in improved farm conditions.

The average milk production for the entire country is something like half the average production of the cows of the most advanced dairy countries in Europe. This would be inexplicable were it not for the fact that less than 3 per cent of the dairy cows of America are pure bred. The field for improvement, therefore, is vast, and the opportunity for useful service is stimulating in the extreme.

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U. S. Department of Agriculture.
Abstract No. 14.

WORLD'S DAIRY CONGRESS, 1923.

ABSTRACT.

FUNDAMENTAL ASPECTS OF DAIRY MARKETING.

By L. D. H. WELD, Manager of Commercial Department, Swift & Co., Chicago, Ill.

Butter is marketed on a smaller margin between producer and consumer than perhaps any other commodity. Approximately 70 per cent of the price paid by the New York consumer for a pound of butter finds its way back to the Minnesota or Iowa farmer who produces the cream from which the butter is made.

This fact is significant when it is considered that for farm products in general the farmer gets a much smaller percentage of the retail price—often considerably less than 50 per cent.

The efficiency with which butter is marketed is a monument to the middleman system of marketing and to the enterprise and initiative of individual business men and corporations. A mere recital of the facts about butter marketing blasts the popular notion that the intervention of a series of middlemen means a wide spread between producer and consumer. Middlemen are merely specialists in the performance of services that have to be performed in getting goods from producer to consumer. They have come into existence and remain in existence for the obvious reason that they can perform the marketing services more efficiently and economically than these services can be performed in any other way.

Butter commonly passes through the hands of a number of intermediaries. First it has to be manufactured in the creamery. It has to be hauled perhaps hundreds of miles in refrigerator cars. It is then taken in hand in large quantities by wholesale receivers, who form business contracts with distant creameries, and who pay promptly, according to the current price quotations. Then in larger cities it is commonly broken up into smaller quantities and passes into the hands of jobbers, who in turn sell and deliver a tub at a time to individual retail stores.

Not all butter is handled in this way. Some of the larger manufacturers have their own distributing organizations which sell direct to retailers. The large meat packers, for example, effectively use their great refrigerating and distributing facilities in the marketing of butter. cheese, and other perishable products.

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Not all dairy products are handled on such a small margin between the producer and consumer as is butter. Market milk, for example, yields to the farmer less than half the consumer's price. And yet this product is commonly handled by only one middleman! Butter goes through the hands of three or four middlemen and yet is marketed on a much smaller margin of expense than is milk.

This fact is a good illustration of the principle that the cost of marketing a commodity does not depend upon the number of middlemen that intervene between producer and consumer. The reason for the differences in selling costs is found in the nature of the commodities themselves.

The principal reasons why butter is marketed at a small expense between producer and consumer are as follows: It is a commodity of small bulk and of high intrinsic value, so that the freight is a small item of expense; it moves in large volumes throughout the year; it can be easily handled, and can be readily graded; there are accurate quotations which can be used as a basis for trading; the turnover in dealer's hands is very rapid; there is practically no waste.

The chief reasons why market milk is expensive to market are as follows: It is one of the most perishable of all commodities; it has to be clarified and pasteurized and put in bottles; there is breakage and loss of bottles; it has to be delivered every day on the doorsteps of houses at early hours of the morning. In short, milk is one of the hardest of all commodities to handle; its distribution calls for special and expensive services. It has been demonstrated again and again that the net profits of the large milk distributors are no more than reasonable and that these profits account for an unimportant part of the difference between farm price and consumer price.

It must be remembered that the present efficient system of marketing dairy products has been developed by private individuals and corporations. This does not mean that there is no place for cooperative enterprise, because there surely is, especially at country points; but it does mean that in marketing commodities in distant wholesale markets there has already developed a highly efficient, low-cost system, upon which it is hard to improve.

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U. S. Department of Agriculture.
Abstract No. 15.

WORLD'S DAIRY CONGRESS, 1923.

ABSTRACT.

THE COOPERATIVE MARKETING MOVEMENT.

By AARON SAPIRO, Attorney, 120 Broadway, New York, N. Y.

The dairy industry holds an especial historical interest for the student of producer cooperation. It has been the source of both the original and the most modern forms of such cooperation.

The dairy farmers of Switzerland were the first to see the value of cooperation for production—which, of course. led to cooperation for marketing; and the dairymen of Denmark evolved the hundred per cent pooling, long term, binding contract form of cooperative organization.

This kind of organization is used to-day among American farmers of all types. It has brought outstanding success to the fruit growers of the far west, the tobacco growers, the cotton growers, and innumerable others.

What is more important, the practices which led these dairy farmers to success established our present guiding principle that the true aim of cooperative marketing is the substitution of scientific merchandising for the disorganized dumping of farm products.

Cooperation in the dairy industry holds an even greater than historical interest by reason of the multiplicity of special problems with which the cooperator is confronted.

The paper, of which this is an abstract, discusses the essentials of sound cooperative merchandising, and presents an analysis of these various problems, including the producer's peculiar obligation to the public; the necessity for organization around metropolitan centers, the elimination of conflicting interests between producers who intend to market the fluid product in such centers and the outlying producers who intend to market milk products; and proper handling of the constant surplus.

The solution of this surplus problem through cooperative merchandising, to increase and make more general the demand for cheese and other milk products, is the key to the intelligent marketing of milk.

All of these difficulties are present in a marked degree in this country, and the recognition of the true purpose of cooperative marketing

together with the application of the proper technique are just beginning. This is true in spite of the fact that in volume of general organization American dairymen exceed the activities of any other class of our agricultural producers.

However, there are many commendable examples of modern type organizations which may thus far be cited, such as The Dairymens League Cooperative Association (Inc.), and The Twin City Milk Producers' Association.

Furthermore, the country's dairy leaders are beginning to think and act along correct cooperative lines with the result that the tremendous amount of existing organization is becoming a great asset instead of a hindrance to the development of producer cooperation in the marketing of milk.

A growth is foreshadowed in the immediate future, which will equal if not surpass, the cooperative achievements of any other branch of American agriculture.

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U. S. Department of Agriculture.
Abstract No. 16.

WORLD'S DAIRY CONGRESS, 1923.

ABSTRACT.

COOPERATIVE MARKETING OF MILK.

By JOHN D. MILLER, President of National Milk Producers' Federation, 120 West Forty-Second St., New York City.

As the result of gradual but relentless movements during the past few decades, farmers found themselves in a position where they surrendered the control of their products at production points where prices were but little affected by world-wide demands.

To correct these conditions, farmers have formed associations through which they are attempting to market their products in an orderly way, thus retaining the title to and control of such products until they are sold in markets where prices are determined by nation-wide and even world-wide conditions.

The beginning of cooperative marketing of milk in the United States was the establishment by farmers of locally owned butter and cheese plants. There are now many of these. Some of these local associations market their own products, while among others there is a pronounced movement in the direction of forming State or regional organizations to act as the common selling agents. Through such common selling agents, farmers have been able to establish trade labels and to employ trained salesmen, thus insuring a certain continuity of demand for their products.

In some regions associations have been formed whose principal business is to produce and market condensed and evaporated milk, while in still other regions various milk products are made by associations whose principal business is to supply cities with fluid milk.

During the past year, from two and one-half to three million cases of condensed and evaporated milk have been produced and sold by cooperative associations.

Probably the most rapid development within the past few years has been in regions tributary to cities. In the beginning, nearly all of the organizations formed in such territories were mere bargaining agents with no authority to collect and distribute the proceeds of sales. Some are still operating in this way to the entire satisfaction of their members. Others have found that conditions surrounding them were such that merchandising associations were required an have reorganized accordingly.

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These merchandising associations distribute milk in cities at both wholesale and retail, and also sell to old-line distributing agencies. Some organizations have manufacturing plants used to manufacture surplus milk. They collect the proceeds of all sales and blend them into one fund, making uniform distribution per unit to farmers with certain quality and location differentials. This is popularly known as the "pooling plan."

Organizations supplying milk to cities have attracted the most public notice in that city consumers are so directly interested.

In the beginning the general public, not understanding the purposes of these organizations, were hostile to them, while now the public is distinctly sympathetic and helpful.

While there is no available data showing the aggregate amount of all sales of these associations, it is conservatively estimated that they now amount to at least $500,000,000 per year.

These various associations are financed in different ways. Some are capital stock corporations and are financed by the sale of stock to members. Others are nonstock corporations and are financed by loans from members, while still others are financed by both sales of stocks and loans. Generally, when financed by loans, such loans are paid off periodically from the proceeds of new loans made by members.

The form of the organizations and their methods of financing are so varied that no general statement applies to all.

The efficiency of many of these organizations and the magnitude of their operation are such that they seem to have become a permanent part of the industrial and commercial life of the nation.

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U. S. Department of Agriculture.
Abstract No. 17.

WORLD'S DAIRY CONGRESS, 1923.

ABSTRACT.

RESEARCH AND EDUCATION IN AGRICULTURE, INCLUDING DAIRYING, IN THE UNITED STATES.

By A. C. TRUE, U. S. Department of Agriculture.

In the United States, research and education in dairying and dairy husbandry are carried on in institutions dealing broadly with agriculture. These include the United States Department of Agriculture, State agricultural colleges and experiment stations, and secondary schools maintained by States, counties, or local communities.

The United States Department of Agriculture investigates the breeding, feeding, and management of dairy cattle and the care and handling of milk and the manufacture of dairy products in the Dairy Division of its Bureau of Animal Industry. Other divisions of the department carry on investigations of interest to dairymen and an office of Experiment Stations publishes reports of investigations in dairying in the Experiment Station Record, a technical review of the world's scientific literature relating to agriculture, issued monthly by the department.

Of the 2,100 workers employed in the 50 State experiment stations in the United States about 120 are engaged in investigations in dairying or dairy husbandry; 150 projects on dairy cattle and 118 on dairy products are being carried on by these stations.

Higher education in agriculture, including dairying, is conducted through colleges of agriculture in 48 States. These colleges are organized as parts of universities or as independent colleges of agriculture and mechanic arts. About 150 instructors in dairying are employed in their faculties.

These institutions usually have dairy herds representing several breeds and are equipped with dairy equipment and appliances so that students in dairying can be thoroughly trained in the practice of feeding, caring for, and judging dairy cattle as well as in the principles of animal breeding and feeding.

Instruction in handling milk and manufacturing dairy products is also given, these institutions usually having laboratories where milk is pasteurized and butter, cheese, ice cream, and powdered and condensed milk are made on a nearly commercial basis.

Prior to 1914, information useful to farmers and their families was given them by the agricultural colleges for many years through

farmers' meetings, the distribution of publications, and correspondence. This was combined under the Smith-Lever Extension Act of 1914, with the newer system of carrying helpful information from the United States Department of Agriculture and the State agricultural colleges to farmers and their families through State and county extension agents under whose instructions demonstrations in improved methods were carried on by farmers and their families on the farms and in the farm homes as an example or demonstration to themselves and their neighbors. In each State these extension agents report to a State director of extension, who is jointly responsible to the United States Department of Agriculture and the State agricultural college in the conduct of the cooperative extension work in his State. Federal relations with State directors of extension are maintained through an Office of Cooperative Extension Work in the Extension Service of the United States Department of Agriculture. The Director of the Department Extension Service has general supervision over all extension work of the department.

In the 2,650 agricultural counties of the United States, 2,100 agricultural agents are employed. Eight hundred of these counties have home demonstration agents, trained women working for the improvement of conditions in the farm home, and in 200 counties, extension agents working exclusively with farm boys and girls are employed. Among negroes in the Southern States, 175 men agents and 100 women agents of their own race are employed. Extension work in dairying and in the handling and utilization of dairy products is an important feature of the work of these agents, assisted by cooperating specialists with headquarters at the State agricultural colleges and the United States Department of Agriculture. In 1923, 1,300 county agricultural agents report carrying on extension work in dairying.

Secondary education in agriculture is given in special schools and departments of ordinary secondary (high) schools in the United States. The special schools are branches of agricultural colleges or separate schools in counties or larger districts. There are now about 170 such schools. They have buildings, farms, and live stock. Their agricultural courses cover two to four years and are combined with English, mathematics, elementary science, history, civics, and manual training.

An agricultural department exists in about 2,000 high schools, having usually a single teacher of agriculture and giving agricultural instruction generally covering one or two years. Practical work is usually conducted on the home farms of the students. Both the special and ordinary high schools commonly give dairy instruction as part of their courses in animal husbandry.

[62254] WASHINGTON : GOVERNMENT PRINTING OFFICE : 1923

U. S. Department of Agriculture.
Abstract No. 17.

WORLD'S DAIRY CONGRESS, 1923.

ABSTRACT.

RESEARCH AND EDUCATION IN AGRICULTURE, INCLUDING DAIRYING, IN THE UNITED STATES.

By A. C. TRUE, U. S. Department of Agriculture.

In the United States, research and education in dairying and dairy husbandry are carried on in institutions dealing broadly with agriculture. These include the United States Department of Agriculture, State agricultural colleges and experiment stations, and secondary schools maintained by States, counties, or local communities.

The United States Department of Agriculture investigates the breeding, feeding, and management of dairy cattle and the care and handling of milk and the manufacture of dairy products in the Dairy Division of its Bureau of Animal Industry. Other divisions of the department carry on investigations of interest to dairymen and an office of Experiment Stations publishes reports of investigations in dairying in the Experiment Station Record, a technical review of the world's scientific literature relating to agriculture, issued monthly by the department.

Of the 2,100 workers employed in the 50 State experiment stations in the United States about 120 are engaged in investigations in dairying or dairy husbandry; 150 projects on dairy cattle and 118 on dairy products are being carried on by these stations.

Higher education in agriculture, including dairying, is conducted through colleges of agriculture in 48 States. These colleges are organized as parts of universities or as independent colleges of agriculture and mechanic arts. About 150 instructors in dairying are employed in their faculties.

These institutions usually have dairy herds representing several breeds and are equipped with dairy equipment and appliances so that students in dairying can be thoroughly trained in the practice of feeding, caring for, and judging dairy cattle as well as in the principles of animal breeding and feeding.

Instruction in handling milk and manufacturing dairy products is also given, these institutions usually having laboratories where milk is pasteurized and butter, cheese, ice cream, and powdered and condensed milk are made on a nearly commercial basis.

Prior to 1914, information useful to farmers and their families was given them by the agricultural colleges for many years through

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farmers' meetings, the distribution of publications, and correspondence. This was combined under the Smith-Lever Extension Act of 1914, with the newer system of carrying helpful information from the United States Department of Agriculture and the State agricultural colleges to farmers and their families through State and county extension agents under whose instructions demonstrations in improved methods were carried on by farmers and their families on the farms and in the farm homes as an example or demonstration to themselves and their neighbors. In each State these extension agents report to a State director of extension, who is jointly responsible to the United States Department of Agriculture and the State agricultural college in the conduct of the cooperative extension work in his State. Federal relations with State directors of extension are maintained through an Office of Cooperative Extension Work in the Extension Service of the United States Department of Agriculture. The Director of the Department Extension Service has general supervision over all extension work of the department.

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Secondary education in agriculture is given in special schools and departments of ordinary secondary (high) schools in the United States. The special schools are branches of agricultural colleges or separate schools in counties or larger districts. There are now about 170 such schools. They have buildings, farms, and live stock. Their agricultural courses cover two to four years and are combined with English, mathematics, elementary science, history, civics, and manual training.

An agricultural department exists in about 2,000 high schools, having usually a single teacher of agriculture and giving agricultural instruction generally covering one or two years. Practical work is usually conducted on the home farms of the students. Both the special and ordinary high schools commonly give dairy instruction as part of their courses in animal husbandry.

[62254] WASHINGTON : GOVERNMENT PRINTING OFFICE : 1923

U S. Department of Agriculture.
Abstract No. 20.

WORLD'S DAIRY CONGRESS, 1923.

ABSTRACT.

AN EXPLANATION OF THE DAIRY COUNCIL PROGRAM AND THE METHODS EMPLOYED IN CARRYING IT OUT.

By R. W. BALDERSTON, Secretary, Philadelphia Inter-State Dairy Council, Philaphia, Pa.

The National Dairy Council operates as a national health agency with branches and local group affiliations in all parts of the country. It cooperates in health education, local and national, and institutes and stimulates many new movements, placing its particular emphasis, quite naturally, on proper nutrition. It derives its funds from regular contributions by the various dairy interests.

Its particular contribution to national health is in the dissemination of the knowledge of the newer developments in scientific research in the factors that make for optimum health. But for the sake of efficiency, it specializes in methods of teaching children and adults proper food selection. Dairy Council work, for convenience, is now clearly departmentalized.

FORM OF ORGANIZATION.

I. The nutrition department is always the most important. In its activities are included:

1. Cooperation in nutrition classes.
2. Demonstration of health dishes which emphasize milk and its products.
3. Lectures on health and nutrition to—
   (*a*) Elementary schools.
   (*b*) Women's organizations.
   (*c*) Men's clubs.
   (*d*) High schools.
   (*e*) Professional groups such as nurses and social workers.
4. Supper clubs for young women.
5. Essay, poster, and recipe contests.
6. Literature and posters.

II. Quality control departments, engaged in educational work to improve the quality of our dairy products.

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1. Inspection of milk at collecting plants for—
   (*a*) Sediment.
   (*b*) Bacteria.
   (*c*) Acidity.
2. Farm inspection with score card.
3. Milk plant inspection.
4. Personal visits to dairymen for advice.
5. Educational meetings with lectures and motion pictures.
6. Actual demonstrations of clean safe milk production.
7. Appropriate literature.

III. Health plays, stories, and talks.

1. Children are trained to take part in health plays which emphasize milk.
2. Adult plays.
3. Stories and talks illustrated by actual objects.

IV. General publicity.

1. Newspaper and magazine articles.
2. Advertising in periodicals and newspapers, billboards, and posters.
3. Motion pictures in theaters.

V. Financing.

The Dairy Council is financed by contributors from all branches of the dairy industry. Many interests contribute only to the national work of the National Dairy Council, while others support a local unit organized for intensive effort in a prescribed area but closely affiliated with and assisting in forming the policies of the national organization.

VI. Extent of the work.

The Dairy Council to-day has 19 branches and affiliated units. A few figures will give some idea of the scope of its work. In one city alone this year the dramatic department gave stories and plays before 190,900 people. The National Dairy Council last year distributed 5,000,000 pieces of literature and reached more than 2,000,000 people in audiences. This year the quality control department of the Philadelphia Inter-State Dairy Council held 150 meetings, reaching from 22,000 to 25,000 farmers.

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WASHINGTON : GOVERNMENT PRINTING OFFICE : 1923

U. S. Department of Agriculture.
Abstract No. 22.

WORLD'S DAIRY CONGRESS, 1923.

ABSTRACT.

QUALITY CONTROL WORK OF THE DAIRY COUNCIL.

By C. I. COHEE, Head of Quality Control Department, Philadelphia Inter-State Dairy Council, Philadelphia, Pa.

Because of the importance of milk in the human diet and because the safety of the milk supply bears such a close relation to public health, the dairy industry has important responsibilities for the quality of the product which it produces and distributes. For this reason the Philadelphia Inter-State Dairy Council soon organized a quality control department to cooperate with all other agencies in improving the supply of the territory in which it is operating, and other local councils have been closely following this example.

Two methods may be used to secure a safe supply of milk of good quality. One method is through the enforcement of regulatory legislation. Undoubtedly such legislation has, in many cases, resulted in great improvement in quality and a certain amount of regulation is necessary as a guarantee that minimum standards will be complied with; however, it is a recognized fact that if the cooperation and interest of the producers of milk can be secured and maintained through the means of education, progress will be made far beyond the result of a system of dairy inspection maintained by public officials. As this educational program proceeds these minimum standards can be raised and, supported by public opinion, can be rigidly enforced in the cases of careless individuals.

Educational methods employed.—1. Through sediment tests of the farmers' milk, the very careless producers are discovered and given special personal encouragement and the more careful commended and encouraged. Reinspection of this kind discloses consistent improvement throughout the territory. Some 25,000 such tests have been made in one year at plants supplying Philadelphia.

2. Educational meetings, in cooperation with the State and agricultural extension forces, county agents, the producers' association and other agencies, are held at all points where it is possible to secure an adequate audience. A most important feature of such meetings is the use of educational motion pictures, showing how to produce milk of a satisfactory quality, supplemented by short talks by the field men of the council and others. These field men travel by

automobile, carrying motion picture projector and generator, so it is possible to hold meetings in open air or in any roadside schoolhouse. The Dairy Council produces its own motion pictures. About 150 such educational meetings have been held during the last year, with audiences amounting to 25,000 farmers and their families.

3. Barn inspections are made where it seems desirable and advice is given for improving both equipment and methods.

4. Two booklets have been prepared, printed and distributed, dealing with the production of clean, safe milk.

5. Demonstrations are held wherever advisable, at which our field men perform all operations of milking the cows and the subsequent care of the product from the barn to the cooling station. As many as 75 farmers have attended at one of these demonstrations.

Results.—Results obtained show constant improvement in the quality of the milk delivered. We have helped lower the average temperature of the milk, have eliminated very largely the visible dirt, and have reduced the number of bacteria in milk.

A spirit of rivalry is maintained between various communities in endeavoring to see which can supply milk of the best quality. It is no unusual thing to find that now farmers will frequently visit and talk with their neighbors who have not been careful in the matter of producing clean milk, knowing that the milk of all dairies of a community is mixed together and should one of their number be producing an inferior article it would tend to lower the quality of the combined product of all.

The improvement in the quality of the supply of milk through cooperation and education, in addition to suitable legislation, has proven its worth in every territory where carried out, and it is doubtful if similar results have ever been accomplished elsewhere at so low a figure from the standpoint of financial expenditure.

We have fully demonstrated through the educational work of the quality control department of the Dairy Council that careful production insures satisfied customers and better market conditions for the producer's milk.

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U. S. Department of Agriculture.
Abstract No. 23.

WORLD'S DAIRY CONGRESS, 1923.

ABSTRACT.

RESULTS OF DAIRY COUNCIL WORK FOR INCREASED USE OF MILK.

By W. A. WENTWORTH, Columbus, Ohio, Secretary of the Ohio Dairy Products Association and Formerly Secretary of the Iowa State Dairy Council.

The National Dairy Council and its various local councils have carried on work to increase the use of milk for the purpose of improving public health and eliminating undernourishment in children. Repeated surveys by organizations interested in public welfare have shown that increased consumption of milk is a natural corollary to improvement in health in any successful campaign dealing with nutrition. A few examples of work and results will be mentioned out of many which might be given.

In Dauphin County, Pa., a survey was made by the State agricultural college, and the Dairy Council was asked to cooperate in a year's campaign. In towns where children became regular milk drinkers only 11 per cent of the school children were found seriously underweight, as compared with 33 per cent in the country at large.

Nutrition classes show many cases of children inadequately nourished, physically inactive, listless, and poor in their school work, who, as a result of being taught to use a proper quantity of milk, increased in weight and became active, alert, and happy.

In some cases the Dairy Council cooperates with health programs already started; in other cases it initiates and supervises the programs; and in still others it accepts responsibility for the educational part of the program. Large numbers of children are reached. In Trenton, N. J., for instance, a series of five lessons was given to 16,000 children. In Youngstown, Ohio, after the educational campaign last winter, the consumption of milk increased 13 per cent. In many schools a mid-morning milk lunch service has been installed.

In Philadelphia work was done with the mothers of children in nutrition classes in the public schools. The mothers were gathered in 43 groups and taught the preparation of simple nourishing dishes based on milk. They responded well to this form of teaching. Over 2,000 families were reached in this way.

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Associations of parents and teachers aid in the work. In Bridgeton, N. J., after a health talk by a dairy worker, the Parent-Teacher Association assumed responsibility for the health program in the community. In three months they had reduced the serious underweight nearly 40 per cent, had 50 per cent of the eye defects corrected, inaugurated milk services in the schools, and ended their program with a clean-up and health week.

One difficult class to reach is that of the young women and girls employed in industry. In St. Paul and Philadelphia this situation has been met by organizing supper clubs of 20 to 25 persons each.

In Pittsburgh the Dairy Council has two booths in the parks for weighing and measuring children and giving a health message. In the month of June 12,000 children were weighed and measured.

In St. Paul a contest in preparing food from dairy materials kept the subject of dairy products before the public for several weeks. One thousand housewives competed. Another activity in St. Paul is the annual child health day, established by the Dairy Council in cooperation with other health organizations. At that time the thought of the city is directed to the subject of making and keeping children healthy.

Dramatic presentations are utilized, and many permanent projects have resulted, amongst them the wide distribution of milk lunches in the Philadelphia schools. In Atlantic City the consumption of milk by school children doubled in one week after the milk fairy play. Health plays have been given in department stores, industrial plants, girl scout troops, Young Men's and Young Women's Christian Associations, and nutrition camps.

The methods of the Dairy Council are such that the effects are continuous and cumulative. The council is engaged, with other health organizations, in a permanent educational program to fix in the minds of both parents and children how to secure a strong healthy body as the best safeguard against disease. Through conspicuously successful work the avenues for bringing its teaching before all types of people are now open, and it looks forward confidently to the time when the menace of undernourishment in children will be reduced to a minimum.

[63802]

WASHINGTON : GOVERNMENT PRINTING OFFICE : 1923

U. S. Department of Agriculture.
Abstract No. 23.

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U. S. Department of Agriculture.
Abstract No. 24.

WORLD'S DAIRY CONGRESS, 1923.

ABSTRACT.

THE MILK FAIRIES.

Part of Philadelphia Program.

Johnny refuses to drink milk. As a result of his not drinking milk, and following other health habits, he is undernourished. On his return from a morning's play he is almost exhausted.

While resting under a tree Johnny dreams that some fairies, who say they live in a milk bottle, come to visit him. The Protein King, Mineral, Butterfat, Vitamin and Sugar Fairy Queens bring to Johnny the "Boy Johnny Might Have Been," a strong sturdy fellow who tells Johnny what he is missing by not drinking milk and growing strong.

Johnny is much impressed with the strength and athletic prowess of this "Boy He Might Have Been," and is very happy when the fairies tell him there is still a chance to grow tall and muscular if he will drink milk.

Johnny no longer has to be urged by mother and doctor to drink milk after his beautiful dream of the milk fairies and what they can do for him.

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WASHINGTON : GOVERNMENT PRINTING OFFICE : 1923

U. S. Department of Agiculture.
Abstract No. 25.

WORLD'S DAIRY CONGRESS, 1923.

ABSTRACT.

THE FOOD FAIRIES.

Part of Philadelphia Program.

The Food Fairies represent the five food constituents that are essential to body growth and well-being. In order to appeal to childish imagination, they are called Patrick Protein, Minnie Mineral Matter, Fanny Fat, Sally Sugar, and Viola Vitamine. Each one in turn tells what particular duty he has to perform in keeping children healthy.

After having presented a number of foods in which only one or two of these fairies live, it is found that all five live in the milk bottle. Milk is the only food in which all of these fairies live together and, therefore, the very best food for us all.

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WASHINGTON : GOVERNMENT PRINTING OFFICE : 1923

U. S. Department of Agriculture.
Abstract No. 27.

WORLD'S DAIRY CONGRESS, 1923.

ABSTRACT.

HOW MILK IS MADE.

Part of Philadelphia Program.

Billy, like many other children, is curious to know how milk is made * * * The doctor told him that Mother Nature and Bossy Cow make the milk. Billy meets Mother Nature in the woods and asks how it is done. Mother Nature summons her helpers, the Fairy of the Meadow, the Fairy of the Shady Dell, the Fairy of the Corn Field, and the Fairy of the Brook. Each one tells him her part in helping Mother Nature to make milk. Billy is delighted to find that such lovely elements enter into the composition of milk, and is determined to drink more milk than ever.

63799—23

WASHINGTON : GOVERNMENT PRINTING OFFICE : 1923

U. S. Department of Agriculture.
Abstract No. 28.

WORLD'S DAIRY CONGRESS, 1923.

ABSTRACT.

MAKING THE WORLD FIT.

Part of Philadelphia Program.

Two American girls are shocked to learn that there are so many undernourished girls and boys in America, the Land of Plenty. An astronomer, by a magic telescope, enables them to see the peoples of many other countries. They realize that where dairy products form a large part of the diet, the natives are strongest and best contented.

The girls know that many of these people are yearly coming to America, and the play closes with a plea from Columbia that America profit by the lessons in food selection that these new citizens bring us.

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WASHINGTON : GOVERNMENT PRINTING OFFICE : 1923

U. S. Department of Agriculture.
Abstract No. 29.

WORLD'S DAIRY CONGRESS, 1923.

ABSTRACT.

THE DEVELOPMENT OF DRIED MILK AS A FOOD.

By Col. R. I. BLACKHAM, C. B., C. M. G., C. I. E., D. S. O., M. D., M. R. C. P. E. D. P. H. (London).

During the past 15 years a remarkable increase in the use of dried milk for infant feeding has taken place in the United Kingdom. Simultaneously, an equally marked decrease in the rate of infantile mortality has been observed.

Approximately one hundred and fifty times as much dried milk is being used in welfare centers, by municipalities, and other institutions, as was the case in 1908. During the same period the rate of infant mortality fell by one-third—from 120 per 1,000 in 1908 to 77 per 1,000 in 1922.

This rapid increase in the use of dried milk is shown to have been brought about by the great difficulties in the production and transport of a liquid milk supply suitable for infant feeding, and especially in insuring the use of such supply in the poorer districts of the great towns.

Simultaneously, rapid improvement in the manufacture of dried milks, and the production of roller process dried milks with excellent keeping qualities, have been attained. It is shown that it has been possible to prepare milk powder of constant composition and such bacterial purity as to be almost sterile.

In the United Kingdom practically the whole of the dried milk used for infant feeding has been prepared by the roller process, and the result of these 15 years' experience, involving an enormous number of cases, has been to produce most emphatic clinical evidence that such milks are perfectly adequate for the nourishment of the growing infant both with respect to vitamin value and digestibility.

It is shown that dried milk is exceedingly well adapted to the treatment of infectious diseases, especially typhoid fever. As a galactogogue, it has been shown to be very effective, and its use is increasing

During the war dried milk was extensively used in the British hospitals and ambulances, and for military purposes found preferable to condensed milk.

62256—23

WASHINGTON : GOVERNMENT PRINTING OFFICE : 1923

U. S. Department of Agriculture.
Abstract No. 30.

WORLD'S DAIRY CONGRESS, 1923.

ABSTRACT.

THE USE OF SWEETENED CONDENSED, EVAPORATED, AND POWDERED MILKS FOR FEEDING INFANTS IN THE TROPICS.

By W. E. DEEKS, M. D., M. A., Medical Department, United Fruit Co., 17 Battery Place, New York City.

In the early days of the American occupation of the Canal Zone great difficulties were experienced in finding a suitable food for feeding infants, and the only reliable sources were sweetened condensed milks (ordinary milk condensed to 35 or 40 per cent of its volume and with 40–44 per cent of saccharose added), evaporated milks, and an evaporated milk with the fats removed.

Any formula, to be satisfactory, must have the approximate composition of human milk, must be sterile, and must be simple in character so that the method of preparation is practical. The strength of the milk should be modified according to the age and requirements of the child. The author has given a table that prescribes the times of feeding, the amounts of water, sweetened condensed milk, and evaporated milk that should be fed children ranging in age from 1 day to 12 months. This table shows that the ratio of sweetened condensed milk to evaporated milk is 1–3, and that its dilution is variable according to the age of the infant.

The relative composition of these formulæ is given in a second table which shows the comparative amounts of water, proteins, fats, and sugar. From this table it is evident that the only food elements absent were vitamins; these are supplied by orange juice or tomato juice from raw or canned tomatoes. Lime water added in small quantities neutralizes the acidity of cow's milk and also makes it more digestible.

These formulæ have been used successfully with more than 90 per cent of the children thus fed. They were initiated in 1908 and have been used in all the tropical countries where the United Fruit Co. operates.

In preparing the milk, the amount necessary for the entire day is made in the morning. Enough boiling water is added to the amount

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of sweetened condensed milk to dissolve it. Then the measured quantity of unsweetened milk is stirred in and sufficient boiling water added to make the desired quantity for the day. A few grains of salt are added, and the milk is divided into as many sterile nursing bottles as there are feedings for the day. The bottles are lightly corked with sterile absorbant cotton and set in a cool place until required for use. It is only necessary then to place the bottle in a pan of warm water when feeding time comes.

Sweetened condensed milk has sufficient sugar to preserve it, but, evaporated milk, after the can is opened, is as subject to decomposition as fresh milk. A fresh can should be opened daily, and any excess portion should be used for other purposes. The person preparing the milk should always taste it after opening the can to see that no bacterial decomposition has taken place.

Powdered milks are being used now in the Tropics, and they form a very satisfactory means of preparing infant's food. Its keeping qualities are especially advantageous. Formulæ and their analyses are given along with directions for preparation. This type of milk requires the addition of a sugar (lactose, saccharose, or dextri-Maltose) and if it is found that fats are necessary, fresh cream or cod liver oil may be added.

The author suggests that if some enterprising milk manufacturer would increase the sugar content of milk to 10 per cent by the addition of milk sugar, cane sugar or dextri-Maltose, and then evaporate it down to 40 per cent and market it in 4, 8, 12, and 16 ounce cans, it would greatly simplify the problem of infant feeding. If the butter fat could be increased 25 per cent before evaporating, the result would be ideal.

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WASHINGTON : GOVERNMENT PRINTING OFFICE : 1923

U. S. Department of Agriculture.
Abstract No. 32.

WORLD'S DAIRY CONGRESS, 1923.

ABSTRACT.

VARIATION OF THE VITAMIN "A" CONTENT OF COW'S MILK UNDER DIFFERENT CONDITIONS OF FEEDING.

By Capt. JOHN GOLDING, D. S. O., F. I. C.

The accepted value of cow's milk and dairy products as food for human beings rests not only on their calorific value but also on certain physiological principles, amongst which the vitamins play a significant part.

In view of the known differences in the vitamin content of milk under different conditions of feeding, investigations were instituted into the practicability of maintaining the vitamin "A" content of cow's milk under conditions in which the normal ration tends to be deficient in the factor.

A comparison was made between the variations in the content of the vitamin "A" in the milk of cows kept under winter conditions, such as obtain in the north of England (stall feeding only), of cows partly stall fed and partly at pasture (south country conditions), and of the same cows fed on pasture in the autumn and spring.

An important feature of the latter part of the experiments was the addition of varying quantities of cod liver oil to the ration of the stall-fed cows with a view to restoring the vitamin "A" content to the milk after that factor had been shown to be deficient by feeding the butter to rats.

The daily food of each stall-fed cow consisted of 50 pounds mangolds, 17 pounds seeds hay, and a quantity of concentrates varying from 8 to 15 pounds. These last were composed of maize gluten feed, maize meal, and decorticated ground nut cake.

The diet of the stall-fed cows so affected the vitamin "A" content of their milk that ten times as much of the butter from their milk was required to produce growth in rats as was needed from that of the cows kept entirely on grass.

The reduction in the vitamin "A" content was accompanied by a marked disappearance of the natural pigment of the butter.

The addition, however, of not more than 4 ounces of cod liver oil per cow per day restored the vitamin "A" content of the milk of the stall-fed cows to its full original value.

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No flavor was produced in the butter by the addition of this quantity of good cod liver oil.

The partially grass-fed cows received a diet similar to that of the entirely stall-fed animals.

During January and February the vitamin "A" content of their milk fell almost as low as that of the stall-fed cows, but as spring advanced and the fresh grass began to grow, the vitamin "A" content of their butter improved and its color attained a higher pigment value than in the autumn.

These experiments show that winter feeding may reduce the value of the milk as a source of vitamin "A" to one-tenth its summer value, but that this can be restored by feeding a substance rich in vitamin "A".

How far this fact is of practical importance to the producer and consumer depends upon the requirements of the growing child for vitamin "A."

[62200]

WASHINGTON : GOVERNMENT PRINTING OFFICE : 1923

U. S. Department of Agriculture.
Abstract No. 33.

WORLD'S DAIRY CONGRESS, 1923.

ABSTRACT.

VITAMINS IN PRESERVED MILK.

By CORNELIA KENNEDY, Assistant Professor of Agricultural Biochemistry, University of Minnesota, St. Paul, Minn.

Milk is commonly preserved either by partially drying as in condensed milk or by completely drying as in dried milk.

CONDENSED MILK.

The vitamin content of condensed milk has not been as thoroughly studied as that of other preserved milks and many of the statements in the literature in regard to this question appear to be generalizations rather than results of actual experiments. Hess and also Hume state that sweetened condensed milk retains practically all of its vitamin C. Daniels and Laughlin show that purified rations, to which either unsweetened evaporated milk or sweetened condensed milk was added to supply vitamins A and B, are adequate to support normal growth. Although the vitamin content of condensed milk is adequate to meet the requirements of experimental animals, it may not be when reconstituted as a modified milk for infants.

DRIED MILK.

Vitamins A and B.—The vitamin content of dried milk has been much more carefully studied and fairly definite conclusions can be drawn, although the work has not always been carried out under ideal conditions. Such conditions would be the planning of feeding experiments so that the same milk could be fed both in the fresh condition and in the dried form. A very satisfactory substitute for this method was used in this laboratory in comparative tests of spray and drum processed dried milks by extending the feeding experiments over a period of a year so that any differences in the vitamin content of the milk due to seasonal changes in the food of the cow could be explained as such and not wrongly attributed to the process used in drying. From experiments thus carried out data were obtained which, it is believed, show more exactly the effects of the drying processes on vitamins A and B than has previously been obtained. It was found that growth-promoting vitamin B is not affected by

either the spray or drum process of drying; that the vitamin A content of drum-dried milk more nearly approximates the original milk in this respect than does milk dried by the spray process; and that in both kinds of dried milk a change in the vitamin content may be expected which corresponds to changes found in fresh milk due to seasonal changes in the feed of the cow.

Vitamin C.—Milk powders vary in their content of vitamin C, the antiscorbutic factor, not only because fresh milk varies in its vitamin content but also because experiments so far published show that one process of drying is more destructive to the vitamin than another. Thus it has been repeatedly shown that the drum process of drying, which minimizes the period of exposure to heat and oxidation, does not destroy vitamin C to as great an extent as does the spray process. Although it has never been shown that drum drying has no destructive effect on this factor, it has been found that milk so processed still contains enough of its antiscorbutic properties to protect babies and experimental animals from scurvy.

POWDERED MILK AS INFANTS' FOOD.

While experimental animals are very valuable in determining the biological value of foods with respect to certain constituents, the results so obtained can not be directly applied to children because of the great differences in the rate of growth. Therefore, actual feeding tests have been made with young children to determine if dried milk can satisfactorily replace fresh milk in their dietaries. Results of several workers show that the growth curves of children fed exclusively on dried milk closely resemble those of breast-fed children and that there is no greater tendency in infants so fed to develop rickets and scurvy than in infants fed on fresh cow's milk.

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U. S. Department of Agriculture.
Abstract No. 34.

WORLD'S DAIRY CONGRESS, 1923.

ABSTRACT.

THE USE OF MILK IN BREAD.

By R. M. ALLEN, Director Research Products Department, Ward Baking Company, New York City.

All workers in the field of nutrition have demonstrated the superior food value of whole milk and whole wheat combined. Milk supplies a better balance to the wheat than meat; butter, a better balance than other fat.

Whole wheat is rich in phosphates, but very low in lime, sodium, and chlorine, or sodium chloride, ordinary table salt. It is rich in vitamin B, low in vitamin A. From a mineral salt standpoint it requires additional lime and table salt to put its other valuable mineral salts into a balanced form for proper nutrition. Thus, white flour with its cheap and valuable proteins and starches, whole wheat with its valuable iron, phosphates and other salts, lacked calcium and other food needs which we sought to determine.

In respect to proteins, the wheat germ contains a different kind of protein from that in the white flour, and milk contains still a third form of protein. When these three are combined, better results are assured than when used separately. The wheat germ, in addition to being high in potassium phosphate, contains a large amount of another substance, namely, vitamin B. This is the vitamin found in yeast. On the other hand, milk, while stable in the important vitamin A (associated with butter fat), varies in the amount and strength of vitamin B contained.

After determining the mineral salt, soluble protein, and vitamin B value of wheat and bran, the next problem was to put it in the most palatable form for food. A whole wheat loaf made with milk and some additional soluble calcium salts and table salt was the simplest combination. However, consumers do not like to eat this loaf of bread every day. Furthermore, the salts and vitamines in the bran are not in a form readily assimilable by the human digestive system. To unlock the nutritive properties of bran and germ and add them to white flour to produce a nutritive white bread resulted in the extraction of the solubles from the wheat germ into a standardized extract rich in vitamin B.

After adding the wheat germ extract and milk the loaf was still deficient in calcium salts. Doctor Sherman, of Columbia University, fed white rats a diet consisting of two-thirds whole wheat and one-third whole milk powder. The large amount of whole milk was necessary to get enough vitamin B and secure a calcium balance. While these proportions will not bake up into a palatable loaf of bread, sufficient milk can be used to add liberal amounts of vitamin

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A, and to produce a protein balance, the calcium deficiency can be remedied by the addition of salts direct and the vitamin A deficiency supplied with wheat germ extract.

Tests in this loaf have been conducted in seven different laboratories with the independent conclusions that animals fed on the bread as a sole food show normal growth and reproduction, while those fed on ordinary bread show decline and death.

The nutritional value of the loaf is shown by charts of these feeding tests. These charts give the normal growth curve, the growth curve from feeding the loaf and the composite growth curve from some of the most popular breads on the American market. The charts speak for themselves. No such complete growth curves have ever before been recorded for a single food where the test animals are carried on into adult stage. Hundreds of these animal feeding tests have been made; in some cases animals have been carried into the seventh generation of reproduction on the bread and water alone, each generation normal in growth.

The loaf is made up of the following ingredients: (*a*) Wheat flour; (*b*) an extract rich in vitamin B, soluble proteins and mineral salts from wheat germ and bran; (*c*) whole milk as the only liquid, plus added whole milk solids, including the vitamin A and milk salts; (*d*) soluble calcium salts; (*e*) the usual leavening ingredients, including yeast, salt, shortening, and yeast food. The shortening is, besides butter, selected beef oleomargarine.

The nutritional facts, based upon the standards of Sherman and others and upon actual feeding tests, show that the loaf contains (*a*) proteins of superior food value and of adequate amount and balance for normal growth; (*b*) liberal amounts of vitamin A and B; and (*c*) a well-balanced variety of body-building mineral nutrients.

Arrangements have been made, under competent direction, for the feeding of the loaf to children in institutions and private homes, one group receiving the loaf as their sole cereal food in addition to the average diet of other foods, the other group receiving the same diet with the exception that ordinary white bread and cereals are substituted for the loaf.

The results already confirm the conclusions derived from the animal feeding experiments. Groups receiving the loaf as part of their diet are making uniformly greater gains in height and weight than children of the same age and nationality, and under the same observation, whose diet contains ordinary cereals and ordinary white bread. From the general average of over a thousand of such children the results indicate that a loaf, such as this, is one dependable and economic means to combat undernourishment among children.

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U. S. Department of Agriculture.
Abstract No. 35.

WORLD'S DAIRY CONGRESS, 1923.

ABSTRACT.

USE OF MILK POWDER IN BAKING.

By CHARLES A. GLABAU, American Trade Publishing Co., 287 Broadway, New York, N. Y.

In this paper it is proposed to bring out some of the statistics gathered by the Bureau of Markets and Crop Estimates, Division of Dairy and Poultry products, United States Department of Agriculture, and to point out that there is a means of consuming the milk products wasted and a possibility of increasing the production of milk products for a market which can be cultivated.

It endeavors to point out that the baking industry furnishes a most excellent market for milk products, especially for skim milk solids, as it is estimated that the baker consumes about 40,000,000 barrels of flour per year, which furnishes a market of about 11 pounds of skim milk solids per barrel of flour or about 15½ pounds of whole milk solids per barrel of flour, which should receive serious attention and consideration by the dairy industry.

To illustrate how the consumption of milk is gradually growing in this industry a history of the baking business is given.

In this history the early practice of baking is given together with the gradual development into a tremendous industry in which science plays a prominent part.

In this history is also brought out the baker's early conception of baking, showing how he guided by the rule of thumb and the acceptance with reluctance of the newer light of baking development.

It brings out how milk was gradually introduced into the bakery and how the baker gradually accepted its use first in the finer forms of bakery products such as cakes and pastries, then in rolls and finally in bread.

It gives the bakers' ideas as to milk in bread and in other bakery products.

It illustrates how different forms of milk such as condensed, sweetened condensed, evaporated, skim and whole milk powder, and buttermilk are used.

The economics of milk in bread are brought out as one of the most important to the dairyman, baker, and country at large, showing the

economic difference between the use of the surplus milk for human consumption and animal feeding.

To show that milk in bread is a matter of vast economic importance, the physiological results are brought out by showing collected data on feeding tests carried out with albino rats and also feeding tests carried out by the writer.

An attempt is made to show that it is advisable that the dairyman make a study of the baking industry as it relates to the use of milk, which is of utmost importance to him as a producer of this product.

Lastly, it is shown that it is important to make bread a greater food by making milk one of its principal adjuncts so as to increase the nutritive value of the "staff of life" which, after all will cause a greater consumption of this product with an increase not only in the consumption of milk, but also of meat and other foods, which put the country in a better economic condition and make better men, women, and children.

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U. S. Department of Agriculture.
Abstract No. 37.

WORLD'S DAIRY CONGRESS, 1923.

ABSTRACT.

DAIRY AND FACTORY MANAGEMENT.

By Prof. A. PETER, Director of the Dairy School at Rutti-Zollikofen, Switzerland.

It was requested that the teaching of dairy and factory management be made a special subject for lectures in the secondary dairy schools and in the agricultural and dairy departments of universities and technical high schools. Of course, this subject can only be profitably presented to students of dairying or agriculture who have already had a thorough grounding in dairy science and a considerable amount of practical experience.

The English text of this paper also contains a short index of my book "Milchwirtschaftliche Betriebslehre" ("Dairy Economics") published by Paul Parey, Berlin, second edition, 1923.

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U. S. Department of Agriculture.
Abstract No. 38.

WORLD'S DAIRY CONGRESS, 1923.

ABSTRACT.

THE ORGANIZATION OF UNITED DAIRIES (LTD.).

By J. H. MAGGS, Chairman of Directors, United Dairies (Ltd.), 34, Palace Court, London, W. 2.

United Dairies (Ltd.) is the largest British dairy company. Founded in 1915, it was originally an amalgamation of the three largest wholesale milk distributing companies in London—the Dairy Supply Company (Ltd.), the Great Western and Metropolitan Dairies (Ltd.), and the Wilts United Dairies (Ltd.). The shareholders of the old companies accepted scrip in the new company in exchange for their old shares. United Dairies (Ltd.) was launched with a capital of £1,000,000.

SUBSIDIARY COMPANIES.

London Wholesale Dairies (Ltd.) distribute milk and cream wholesale in London and suburbs.

United Dairies (Wholesale) (Ltd.) control 40 creameries in the best dairying districts in England and Wales.

Edwards's Creameries (Ltd.) manufacture and distribute cream and casein.

Wilts United Dairies (Ltd.) control the condensed milk, butter, and cheese businesses and the import, distribution, and export of table delicacies. The Dairy Supply Co. (Ltd.) control the engineering side.

REORGANIZATION OF THE RETAIL TRADE.

In 1917 the greater part of the large milk-retailing businesses transferred their interests to United Dairies (Ltd.). London is now divided into 14 zones and milk is delivered twice daily to about 500,000 different homes.

MANAGEMENT.

The board of directors is composed of eight managing directors. Under the board of directors are various committees. The executive committee gives effect to the decision of the board and controls finance, property, and the head office departments, also legal, architectural, engineering, estates, and laboratory matters. The milk

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committee controls the policy of milk buying, farm inspection, and relations with producers' organizations. The manufacturing committee deals with manufacture, sales, and advertising. There are also the transport committee, the laboratory committee, the provisions committee, and the engineering committee.

TOTAL TURNOVER.

The volume of business is represented by a turnover of £20,000,000 per annum and the quantity of milk dealt with last year was over 1,080,000,000 pounds.

SOCIAL ACTIVITIES.

United Dairies (Ltd.) finds employment for over 10,000 persons. A social and welfare council and sport clubs have been formed. During the winter arrangements are made for concerts, carnivals, dances, and dramatic performances. The council is engaged upon schemes which include the provision of rest homes and the establishment of savings clubs and superannuation. A house magazine, known as Our Notebook, is published quarterly.

BALANCE SHEETS.

The following summary of the balance sheets of United Dairies tells its own story:

To June 30—	Issued capital.	Net profit.
1916	£932,902	£66,549
1917	940,155	104,798
1918	2,331,489	153,448
1919	2,430,681	233,444
1920	3,281,336	279,668
1921	3,451,241	356,185
1922	3,908,799	452,691

There are over 12,000 shareholders.

EFFECT ON PUBLIC HEALTH.

London leads the large cities of the world in the lowness of its infant mortality rate, and it is recognized that pasteurization of milk was a great factor in recent reductions. In London alone the United Dairies' laboratory examines more than seven times the number of samples of milk and cream that are examined by the public authorities in the whole of England and Wales.

Standards for certified Grade "A" and pasteurized milks necessitates a bottle delivery. United Dairies (Ltd.) welcome any wise legislation for the betterment of the milk supply.

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U. S. Department of Agriculture.
Abstract No. 39.

WORLD'S DAIRY CONGRESS, 1923.

ABSTRACT.

THE MEAT PACKER AS A DISTRIBUTOR OF DAIRY PRODUCTS.

By L. D. H. WELD, Manager, Commercial Research Department, Swift & Co., Chicago, Ill.

The meat packer has become one of the most important distributors of butter and cheese in the United States. It is important to know why the packer has entered this field and what advantages there are to producers and consumers in this form of distribution.

The fundamental reason why the packer began handling dairy products lies in the fact that he had developed a far-reaching sales organization for the distribution of meat, which is a highly perishable product. He had refrigerated warehouses and refrigerator cars. It was only natural that butter, eggs, cheese, and poultry should be added, especially as these products made greater volume and lower selling expense. The same salesmen could sell the products, and they were bought by the same class of retailers.

In distributing dairy products, the packer sells direct to retail dealers. He has assembling plants through the Middle West where butter is manufactured, and direct shipments in refrigerator cars are made by these assembling plants to the packer's own distributing houses in cities all over the country, from which sale is made direct to retailers. Small creameries and many large ones necessarily sell through wholesale dealers and jobbers, in order to reach the retailer.

The creameries of the packer are scattered about in the farming regions where dairying is not a highly specialized occupation, and where small local creameries could not get enough cream for economical operation. The buttermilk from the creamery is used to fatten poultry. When butter volume is light, volume of poultry handled is heavy, so that the overhead expenses are kept at a minimum. In butter manufacture, the cream is pasteurized and the most approved equipment is used. Special consideration is given to sanitation.

It will be seen from these facts that the packer has performed an important service to dairy producers. He has placed efficiently operated creameries in close proximity to thousands of farmers in regions where dairy production doesn't justify local creameries. He has widened the market by making available his extensive selling organization, which reaches all parts of the country.

In handling cheese, the packer is not a manufacturer. He makes purchases in cheese districts of Wisconsin and New York, and the product is shipped direct in refrigerator cars to branch houses, where it is distributed the same as butter.

When these facts are taken into consideration, it is not surprising to learn that the meat packer has become an integral and vital part of the dairy marketing machinery of the United States.

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U. S. Department of Agriculture.
Abstract No. 40.

WORLD'S DAIRY CONGRESS, 1923.

ABSTRACT.

THE FUNCTION OF THE LOCAL BANK IN FINANCING THE FARMER.

By E. B. HARSHAW, Cashier, Grove City National Bank, Grove City, Pa.

It is generally acknowledged that agriculture is the basic foundation of our country's progress, and that the prosperity of the farmer is one standard by which we measure our national wealth, but never in the history of this country has the problem of financing the farmer been so acute.

This has been caused by the deflation from war prices, and it is generally conceded that during the deflation of all industries following the war the farmer has received the worst of it.

The farmers' need of to-day is more credit of three kinds, long-term, intermediate, and short-term, but just how to provide these credits in a proper manner are problems that are confronting the banker, business man, and farmer.

For the purchase, equipment, and improvement of farm land the farmer needs long-time credit which in former days had been provided by mortgage companies or individuals, but which proved to be too expensive and uneconomical. For the carrying of his crops from planting time to harvest he needs intermediate credit, and for the moving of his crops to market he needs short-time credit.

There are many forms of legislation for providing these different credits, some good and some not so good. There is no short cut to sound finance and prosperity, and conditions to a certain extent must adjust themselves and work out their own solutions, but it takes longer to do this in agriculture, it seems, than in any other line of business.

There are two problems which, if properly solved, will contribute much toward placing the farmer on a stable footing, and these go together—cooperative marketing and proper financing.

Most of our farmers market individually, which is very expensive and unsatisfactory because of improper distribution and lack of grading of farm products. Cooperative associations have shown that where the products are gathered to a central point and properly graded, better prices are obtained for the products and a sure and ready market is always available.

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All the farmer's problems touch at some point upon his proper financing and always his local bank must be his main source of credit, but many times in the past the local bank's resources were not sufficient at crop-moving times and the farmer's turnover was not rapid enough to give the banker a liquid loan.

The successful way to handle any problem is to find the man who knows and while knowing is on the ground and can see the progress of the problem at first hand and is in position to be in constant touch with it. In all of these matters the local bankers are preeminently the men and an increasing interest in the problems of agriculture is being shown by the business men and bankers in the larger centers. They are beginning to realize more fully that the prosperity of business depends on the purchasing power of the farmer and that a curtailment of his output means stagnation.

Agriculture should not be satisfied with anything but the best system of financing, and while there are many forms of legislation, there will no doubt have to be some readjustment made before they can function properly.

It is necessary, therefore, that every business man and banker acquaint himself with the agricultural conditions of his own community and do what he can to aid in solving the agricultural problems of his own locality.

If every banker in the country were as interested in taking care of the farmer and studied his needs as much as he has heretofore studied and been interested in the merchant and manufacturer, he would discover some means of taking care of the farmer's needs just as he has taken care of a customer in another line of business.

Recently much legislation has been passed for financing the farmer's various needs, but it can only be successfully worked out by the local banker's studying it, understanding it, accepting and assisting in its operation.

If this were done the agricultural problems of the Nation would be solved.

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U. S. Department of Agriculture.
Abstract No. 41.

WORLD'S DAIRY CONGRESS, 1923.

ABSTRACT.

COOPERATION AS A FACTOR IN STABILIZING THE MARKET FOR AGRICULTURAL PRODUCTS.

By STEPHEN IVAN MILLER, Jr., Dean of the College of Business Administration, University of Washington, Seattle, Wash.

Communities have become competitive and a new community must exercise economic vigilance to meet the competition of other States and communities. Dairying now rivals many other forms of industry in capital requirements. Natural evolution has brought radical changes in agriculture and the semipaternalistic attitude resulting in the effort of the community to protect itself through cooperative effort should not be viewed with alarm. The farmer rarely goes out of business even when he is producing at a loss, and consequently agricultural supply does not readily adjust itself to changing conditions in demand.

Cooperation that may help the farmer includes producer's credit. Until a credit system has been established that will permit the farmer to store and hold until such time as the market will absorb the product agricultural prices will be depressed and destabilized.

The 40 per cent of the consumer's price of farm products which it is estimated goes to the middleman does not necessarily represent abnormal profits, but rather the failure to distribute farm products with economy. If farm products could be merchandized by fewer middlemen of a more efficient type the resulting low unit cost would make possible a higher price to the farmer or a lower price to the consumer.

One of the chief causes for agricultural depression is the inelasticity of the supply of agricultural products due to the fact that the farmer continues to produce when the supply has already passed beyond the power of the market to absorb it at a fair return to the cultivator.

Cooperation among farmers is one of the most constructive steps in solving these problems, but it must be appreciated that its success depends on the education of the membership and the vision and esprit developed in the organization.

Cooperation tends to standardize quality and quantity. Also, it tends to produce a better distribution upon the existing market and through an increased appreciation of the value of publicity and advertising to expand and develop the market.

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U. S. Department of Agriculture.
Abstract No. 42.

WORLD'S DAIRY CONGRESS, 1923.

ABSTRACT.

STATUS OF TRADE ASSOCIATIONS IN THE DAIRY INDUSTRY FROM THE STANDPOINT OF ECONOMICS.

R. E. LITTLE, Secretary, International Association of Milk Dealers, 139 North Clark Street, Chicago, Ill.

Economics has to do with the wealth of nations. In what respect, if any, do modern trade associations have to do with or affect those fundamental factors of a nation's growth as studied in the economical field? Do they serve a purpose from the standpoint of a producer, or is their existence purely predatory or parasitic upon the industrial fabric of a nation? In either event, the fact that they are organizations of a nation's business subjects them to study and analysis from an economical viewpoint. If the former, they are vitally necessary to progress and will prevail. If the latter, they are an evil encumbrance and will fall of their own weight.

In America various trade associations have been attacked by legislative and regulatory bodies on the theory that the activities of such organizations have interfered with free and open competition. The law-making bodies, therefore, clearly recognize the fact that our trade associations have materially to do with a nation's commercial affairs and that in functioning such group organizations must harmonize in their activities with the economic benefits which must naturally flow from a competitive system of industry.

A definition of a trade association can best be devised from an understanding of its functions. An examination of these features should also serve to disclose whether the relations of the trade association to a nation's economics are beneficiary or otherwise.

"A trade association is an organization of producers or distributors of a commodity upon a mutual basis for the purpose of promoting the business of their branch of the industry and improving their service to the public through the compilation and distribution of information, the establishment of trade standards, and the cooperative handling of problems common to the production or distribution of the commodity or service with which they are concerned."

While the activities of trade associations are necessarily many and varied, the following are likely to be found in any such association,

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any or all of which have to do with the immediate economic welfare of the members:

1. Scientific research.
2. Industrial research.
3. Market expansion.
4. Legislative problems.
5. Transportation.
6. Protective work.
7. Prevention of trade abuses.
8. Establishment and standardization of trade terms, names, and customs; standardization and simplification of plant equipment.
9. Publicity.

Great national trade associations, in the modern sense of the word, came into existence in this country about 60 years ago, and a large number of them have an honorable record of from 25 to 50 years to their credit. There are about 1,000 trade associations in America. Their activity as a part of American enterprise in business has only begun. Their development in the next 10 years will be one of the most prominent features of our economic growth. Within that time it is reasonable to prophesy that every industry that would survive will be organized. In the various branches of the dairy industry in America alone there are approximately 18 national or international associations, not to mention about 50 local or regional associations.

Clearly, again, the purposes of corporations and of trade associations are different. Trade associations complement the corporations Corporations, or other firms, exist to do business, to capitalize service in business, to manufacture, to sell, and to distribute. Trade associations are not "in business." They do not manufacture; generally they do not distribute or sell. Their aim is to facilitate these and other commercial or governmental processes.

Virtually every alert industry has come to accept the principle that its success turns on reliable and complete trade information or statistics—in a word, commercial intelligence. As well try to run an ocean-going steamship without navigation charts as direct any modern business without guidance. In other words, each industry needs a watchtower to keep its progress stabilized.

The larger thought is that America, and the lesson can be applied to the other countries, is entering upon a period in which nature no longer offers a lap overflowing with plenty. Save in the unexplored frontiers of science, our pioneers have for the most part done their work. These, then, are the days of refinements in our processes if we are to keep our place in the sun; and these are the days of cooperation accordingly.

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U. S. Department of Agriculture.
Abstract No. 43.

WORLD'S DAIRY CONGRESS, 1923.

ABSTRACT.

THE DAIRY INDUSTRY IN NORWAY.

By R. MORK, Assistant Professor, Norwegian Agricultural College, Aas, Norway.

The total production of cow's milk in Norway since 1900 has been estimated at the following figures:

Year.	Milk (million kilograms).
1900	885
1907	1,000
1915	1,120
1920	1,100

The utilization of the 1920 milk production was:

	Milk (million kilograms).	Per cent.
Consumed as milk	610	55.5
Butter production	265	24.1
Cheese	133	12.1
Condensed milk, etc	42	3.8
Fed to calves, etc	50	4.5
Total	1,100	100.0

The total number of butter factories, cheese factories, milk plants, and condensaries and the total receipt of milk in factories were:

Year.	Factories.	Milk (million kilograms).
1890	307	77
1900	845	184
1910	738	278
1915	694	305
1920	552	281

The milk production, in the years between 1895 and 1917, has been great enough to satisfy the domestic demand for milk and milk products. Since the World War the imports have exceeded the exports by about 3.5 million kilograms. It is assumed that within a few years the production will suffice for maintaining an export, especially of cheese.

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U. S. Department of Agriculture.
Abstract No. 44.

WORLD'S DAIRY CONGRESS, 1923.

ABSTRACT.

INTERNATIONAL ORGANIZATION FOR THE UTILIZATION OF MILK.

By Prof. Dr. E. LAUR, Director, Swiss Federation of Farmers, Broug, Switzerland.

The price of milk is strongly influenced by the prices of butter, cheese, and condensed milk. At the present time these are commodities of international commerce, consequently, the price of milk is influenced by the trend of the world market. The commerce, and partially the production, of milk products is internationally organized and for that reason the international participation of the producers is nil or else very slight. That is why, among other causes, the price of milk in many countries does not cover the costs of production.

However, there has been an information service for the international markets of milk and milk products operating in Switzerland for the past 15 years; this service was organized by the office of price investigations from the Swiss Federation of Farmers. Fifty-seven reports have appeared thus far, published quarterly in French and German besides an abstract in English and Italian. The Swiss Federation of Farmers has borne all the expense. It is earnestly desired that the agricultural organizations in all countries producing dairy products will lend their moral and financial support to the projection of this work.

Likewise, the milk producers should also create an organization that at the same time would permit an active exchange of views on all that is of interest concerning the international marketing of milk and milk products. This organization should be independent of the buyers and consumers. We propose the foundation of an international commission which will convene once or twice a year and will give instructions on the fixation of the price of milk as well as information on the amount and kind of production of milk, and dairy products.

The commission would have as its special duties:

(*a*) A review and examination of the market conditions.

(*b*) The fixation of a reasonable price for retailing milk.

(*c*) Influencing the supply of milk in order to assure a price proportionate to the costs of production.

This object is to be attained in the following ways:

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(1) By advice and decisions concerning the influence on the amount of milk production due to the increase or decrease of stock raising or the extensive or sparing use of forage concentrates.

(2) By advice and decisions as to the greater or lesser advantages obtained from the various methods of utilizing milk.

(3) By giving out information and propaganda to stimulate the use of milk and milk products.

(4) By bringing about the creation of an international wholesale and retail organization for handling milk and milk products, also in conjunction with the trade.

(*d*) The members of the Commission to be named by the milk producers associations in the various countries.

Each association is entitled to send as many delegates as it has proportionate stock subscriptions. However, in the voting no single country can have more than one-sixth of the total number of votes cast. The annual assesment will be determined by the commission. Shares for the first year will be fixed at $200 each. The assessment in countries with greatly depreciated currency may be reduced but at the same time the voting right of said country is reduced to a maximum of two. The conduct of current business will be intrusted to a single organization or to all the associated organizations of one country.

In consideration of the foregoing we take it upon ourselves to recommend the following resolutions for adoption by the Congress:

1. That the international associations for the advancement and support of agricultural and dairy science recommend the promotion of price fixation in the marketing of milk and milk products as undertaken by the Swiss Farmers' Federation.

2. That they sponsor the foundation of an international commission for milk producers.

3. That the Congress appoint a committee that will prepare the statutes of the commission during the course of the congress and designate a provisional meeting place for the first session of the constitutive assembly.

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U. S. Department of Agriculture.
Abstract No. 47.

WORLD'S DAIRY CONGRESS, 1923.

ABSTRACT.

THE RELATION OF ENSILAGE TO CHEESEMAKING.

By Dr. ROBERT BURRI, Director, Swiss Dairy and Bacteriological Institute, Liebefeld, Bern, Switzerland.

I. Conditions for growth of micro-organisms in the silo.—Numerous micro-organisms are found, as a rule, in the green or dried vegetable matter that is prepared by various processes for preservation in silos. The growth of the organisms is affected and, in general, determined in a very definite way by the kind of plants used, their mositure content, the fineness of the particles, the depth of the layers, etc. Either the lactic acid fermentation predominates and suppresses all other fermenting processes or the lactic acid fermentation is accompanied by fermentations brought about by other organisms, chiefly spore-producing bacteria, or these latter exclude the former entirely. The combined effect of these conditions of growth in any given silo determines the nature (microbiological) of the silage and therefore, also the color, smell and taste, as well as the suitability of the silage for use in producing milk for certain milk products.

II. The results of bacteriological investigations with samples of Swiss ensilage.—Following the wave of propaganda that swept over Switzerland a few years ago recommending the use of green fodder ensilage, the experiment station at Liebefeld was placed in a position to investigate the various types of ensilage.

(*a*) *Sweet green fodder ensilage.*—This type of silage preparation, which is very similar to what was called sweet silage, was recommended 40 years ago. Lactic acid fermentation does not take place, as a rule, in this ensilage but instead, spores of the ordinary butyric acid bacilli appear in greater or lesser amounts even when the silage does not smell strongly of butyric acid.

(*b*) *Electrified ensilage.*—A new type, wherein the newly packed silage serves as the resistance for an electric current which heats the silage to the desired temperature. The samples tested by us showed a strong growth of lactic acid bacteria, but spores of the butyric acid bacilli were also present in even larger numbers.

(*c*) *Sour ensilage.*—Layers of vegetable matter of various kinds are packed without any special heating treatment. Various kinds of corn were pepared at the experimental farm, i. e., green and dried

fodder. These silages also yielded numerous lactic acid bacteria and also appreciable numbers of butyric acid bacilli, as did the previously mentioned products. On the other hand, corn silage prepared according to the American process (using the fodder when the corn is beginning to mature) gave a fairly pure lactic acid fermentation, so that the final product contained almost no butyric acid bacilli spores.

III. Experiments on the suitability of milk from silo dairies for use in cheesemaking.—Milk produced by cows fed on the different types of silage was used in the peparation of Emmenthaler cheese in our experimental creamery and in other cheese factories. The result was an unusually unfavorable growth of butyric acid bacilli in the cheese that gave the cheese a gaseous inflation, a bad taste and smell and was the cause for the corresponding depreciated value of the products. There can be no doubt as to the relationship between the butyric acid fermentation in the ensilage and the butyric acid fermenation in the cheese. Of all the ensilages used, only the corn silage prepared according to the American method insures, to some extent, cheese free from the above-mentioned defects.

IV. On the question of the relationship of "Stinker" cheese to Emmenthaler cheese spoiled by butyric acid fermentation.—Experiments with the somewhat numerous defective cheeses (so-called Stinkers) of the American Emmenthaler cheese factories have shown us that the direct cause of defective cheese may be attributed, at least partially, to the presence of butyric acid bacilli contained in unsuitable silage as is the case with the spoiled Emmenthaler cheese in Switzerland. This gives rise to the conjecture that the highly developed use of silage in America may be connected with this frequent occurrence of the above mentioned defects. Contrary to this idea is the fact that only the American type of corn silage guarantees more than any other silage a pure lactic acid fermentation without the accompanying butyric acid fermentation, and it can be deduced from experiments made in America that there is no incompatibility between the use of silage and the making of cheese. But it must still be taken into consideration that occasionally, due to various influences, the corn also produces imperfect silage, which is favorable for the harmful infection of the milk, and in turn for the occurrence of the defects in question.

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WORLD'S DAIRY CONGRESS, 1923.

ABSTRACT.

THE PASTEURIZATION OF CHEESE.

By S. K. ROBINSON, Chief Chemist, J. L. Kraft & Bros. Co., Chicago, Ill.

This paper considers only the reheating of commercial cheese up to pasteurization temperature. It does not concern itself with the pasteurization of milk prior to the manufacture of the cheese. This industry gained considerable importance in the last three years, through the advent of loaf cheese. Pasteurizing the cheese just before it is ready for consumption is probably the best method of solving the pasteurization problem on this dairy product. The reasons for this belief are as follows:

1. By this method cheese can be blended so as to obtain a more uniform and characteristic flavor.
2. The pasteurization is carried out on the cheese within a few weeks of its final consumption.
3. The manufacturer who properly understands the methods, can by pasteurizing the solid cheese, obtain a product that is superior not only from a health standpoint, but from the standpoint of keeping qualities as well.

Experiments showing different properties of pasteurized cheese are given.

METHODS OF PREPARATION.

There are different methods in use in the United States to-day. Essentially, preparation consists of grinding the cheese, heating in a jacketed container with agitation, and filling into the proper containers either directly, or by specially designed machinery.

CHANGES THAT OCCUR WHEN CHEESE IS HEATED.

When the cheese is heated there is at first a slight separation of butter fat, so that the cheese particles appear oily. With more heat the cheese becomes plastic or stringy, and is said to "pull up." Upon further agitation this plastic condition is gradually broken up and a homogeneous mass resembling very heavy cream results, with no plastic properties.

Microphotographs of the different stages will be shown.

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CHEMICAL AND PHYSICAL PRINCIPLES INVOLVED.

During this reheating process conditions are favorable for emulsification. The plasticity of the casein is probably most important because it acts as the cementing agent for all the other ingredients.

Not all casein and paracasein bodies are plastic, and neither is the paracasein in cheese always plastic. This depends on the method of manufacture, degree of ripening, and acid development in the cheese.

BLENDING OF CHEESE.

For best results cheese having the desired properties must be blended. This is the surest method of getting reliable results. The pasteurization always brings out the defects in the cheese.

To get the best results an examination of the paracasein must be made. Also the finished product desired must be considered.

An analysis is given of a typical cheese that is suitable for pasteurization:

Moisture	per cent	36.87
Acid	c. c	*120
Ash	per cent	3.03
Salt	do	.35
Lime (CaO)	do	.98
Total N	do	4.27
Water soluble N	do	.65
Salt soluble N	do	3.35
Formal titration	c. c	*58

* n/10 NaOH per 100 grams of cheese.

APPLICATION OF PROCESS TO DIFFERENT KINDS OF CHEESE.

The pasteurization of cheese has a wide application. American Cheddar, Swiss, Brick, Limburger and even Camembert cheese have all been successfully treated. There are several exceptions in the soft cheese group, due to certain complex changes in the casein.

THE EFFECT OF TEMPERATURE AND SALTS.

The temperature is very important and must be carefully watched. Some cheese can stand more heat than others. Certain salts are important, both from the standpoint of effective pasteurization and proper emulsification. These salts probably act by influencing the electric charges of the colloids.

SCORING OF CHEESE.

In the plastic state, the cheese should have strands about 15 inches in length; they should not be tough. There should be no free fat or moisture. A noticeable gloss on the cheese is desirable.

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WORLD'S DAIRY CONGRESS, 1923.

ABSTRACT.

PASTEURIZATION OF MILK FOR CHEDDAR CHEESE MAKING IN NEW ZEALAND.

By CHARLES STEVENSON, Dairy Instructor, Dairy Division, Department of Agriculture, Wellington, New Zealand.

It is a well-known fact that a uniformly good quality of cheese depends upon the high quality of the milk from which it is made, but where cheese factories collect milk from dairies having varying standards of cleanliness this high quality can not be insured.

The practice of pasteurizing the milk, as a solution of the same problem in butter making, met with such success that it was thought worthy of trial for cheese. The early experiments on small quantities of milk yielded sufficient data to indicate the results that might be obtained when working on a commercial scale. At first, progress was handicapped by the lack of any equipment large enough to handle the quantities of milk necessary for manufacturing purposes, but this difficulty was eventually overcome by the importation of regenerative heaters from Denmark. These heaters have capacity ratings of 800 to 1,800 gallons of milk per hour while heating to a temperature of 160° to 165° F. The heat in most plants is supplied from the exhaust steam of the engines, saving about 10 to 15 per cent the fuel cost of plants where live steam is used.

It has been found that a temperature of 160° to 165° F. is the one best suited to cheese-making plants. If the temperature falls below 160° F., the flavor of the cheese is deteriorated, and if allowed to rise above 165° F. the result is a mealy bodied cheese.

A good quality starter is necessary, and excellent results are obtained by using 1 to $1\frac{1}{4}$ per cent. More rennet is required when pasteurized milk is used, and an increase of one-half ounce per 1,000 pounds of milk is advisable.

Of the many advantages claimed for this method of cheese manufacture, that of improved quality is most outstanding. In addition, the superior keeping qualities and the decrease in the loss of fat in the cheese are also of economic importance. Although the pasteurization of the milk used in cheese has not yet been required by law, the dairy division of New Zealand has taken every opportunity to impress the advantages of the system on the manufacturers, and at the present time 38,000 tons of cheese, or about two-thirds of all produced in the Dominion, is made from pasteurized milk.

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ABSTRACT.

THE USE OF BACTERIAL CULTURES FOR CONTROLLING THE FERMENTATION IN EMMENTAL CHEESE.

By Dr. J. M. SHERMAN, Bacteriologist, Dairy Division, U. S. Department of Agriculture, Washington, D. C.

It is the purpose of this paper to deal with the progress which has been made by the United States Department of Agriculture in the improvement of our domestic cheese of the Emmental type by the use of bacterial cultures.

The developments which have taken place in this work in America are not so much the discovery of the types of bacteria in Emmental cheese (that was done by Von Freudenrich and his various co-workers many years ago) as their application in the industry.

The control of the initial fermentation.—In order that the proper fermentation of the lactose may be initiated, and undesirable fermentations, especially gassy fermentations, suppressed, Doane and Eldridge used a culture of *Lactobacillus bulgaricus.* This organism, which is closely related to the *B. casei* (E) of Von Freudenrich (*Thermobacterium helveticum,* Orla-Jensen), has now been used in this country for a number of years with marked success.

Contrary to the experience of some of the European workers with the *helveticum* type, the *Lactobacillus bulgaricus* which we have used does not appear to contribute directly to the flavor of the cheese, though indirectly, through the suppression of undesirable bacteria, a general improvement in quality is effected.

The production of eyes and flavor.—Although it was over 15 years ago that Von Freudenrich and Orla-Jensen isolated propionic acid-producing bacteria from Emmental cheese, practically nothing was done during the decade following their discovery toward the practical utilization of these organisms in the manufacture of cheese. In America, the domestic cheese of the Emmental type is usually lacking in the characteristic sweetish flavor, and is frequently either deficient or abnormal in eye formation.

To overcome these defects we have used a variety of the propionic acid-producing bacteria, *Bacterium acidi-propionici* (d) which insures the development of the characteristic flavor as well as the formation

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of eyes. Five years' experience with this culture in both laboratory and factory experiments has convinced us that it is the most essential of any single organism to the production of the desirable characteristics of Emmental cheese. Although it appears to be able, almost by itself, to produce the desirable qualities of Emmental cheese, it apparently plays little, if any, part in the suppression of the undesirable organisms which so frequently injure the quality of the cheese.

The control of overswelling.—The frequent difficulty in the manufacture of Emmental cheese in America, and perhaps elsewhere, is a tendency for the cheese to overswell. The cheese so affected usually develops more rapidly than the normal cheese, but sometimes this overswelling occurs in cheeses which have not developed abnormally fast. While defects of this nature are probably due to various causes, very encouraging results have been obtained in their control by the use of another pure culture.

The organism used for this purpose is the organism originally found in cheese by Von Freudenrich and named by him *B. casei* (a). As is well known by everyone who has studied the bacteriology of Emmental cheese, this organism develops in large numbers during the curing process, and is the type which is usually found predominating in the well-ripened cheese. It might seem, therefore, that there is nothing to be gained by the inoculation of the milk for cheese making with this organism, but in certain types of overswelling we have found that its use had a marked beneficial effect in the control of this trouble.

A few results have indicated that the use of this organism may also be of value in the prevention of abnormal flavors, but insufficient data are at hand to establish this point.

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WORLD'S DAIRY CONGRESS, 1923.

ABSTRACT.

NEW DEVELOPMENTS IN THE MANUFACTURE OF SWISS CHEESE IN THE UNITED STATES.

By K. J. MATHESON, Dairy Manufacturing Specialist, United States Department of Agriculture, Washington, D. C.

Since 1918 approximately 20 million pounds of block and wheel Swiss cheese have been made annually in the United States, the most of which is produced in the small factories of Wisconsin, New York and Ohio. Most of the smaller factories receive their milk twice a day, in contrast with the larger factories, which receive their milk but once a day.

There is experimental evidence to show that a high ratio of fat to casein increases the tendency toward glaesler cheese. There is danger of glaesler cheese in the small factories in the months from June to September. It is advisable to standardize the fat-to-casein ratio, not only to correct the milk for seasonal variations in its composition, but to compensate for the smaller rate of loss of fat in the whey in the culture factories as compared with the nonculture factories. The factories designated as "nonculture" used only homemade rennet, whereas the factories designated as "culture" factories used commercial liquid rennet and the bulgaricus and eye and flavor cultures in addition.

Upon the basis of work carried on in Ohio, it seems advisable to standardize milk in the smaller factories during the summer months so that it will have 0.72 of a pound of casein for every pound of fat; and with the rennet extract in culture cheese the milk should have about 0.8 pound of casein for every pound of fat, assuming there is a loss of 0.9 to 1 per cent of fat in the whey of the homemade rennet cheese and only 0.6 to 0.7 in the rennet extract and culture cheese.

The improvement brought about by the use of pure cultures, as compared with the older method in the manufacture of Swiss cheese, is summarized as follows:

1. Pure cultures favor the use of commercial liquid rennet, which makes results more definite and uniform than where stomach rennets are employed.
2. The use of the eye and flavor culture makes it possible to open up the cheese in winter as in summer and to develop a more characteristic flavor.
3. In the fifteen factories where the *Bacilus bulgaricus* has been employed we have never experienced any difficulty with the so-called "stinker" cheese.
4. The employment of pure cultures has increased the price for cheese over that received from nonculture factories in the same locality.

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Centrifuging or clarifying milk for making Swiss cheese reduces the number and increases the size of the eyes. The results with 21 pairs of experimental Swiss cheeses are as follows:

	Fancy grade.	No. 1 grade.	No. 2 grade.
	Per cent.	*Per cent.*	*Per cent.*
Cheese from centrifuged milk	76.2	4.8	19.0
Cheese from milk not centrifuged	38.1	61.9	None.

The uncentrifuged milk was naturally held at a lower temperature, and was less subject to any contamination that may have occurred in the long line of pipes incident to the mixing and handling of the milk. The milk to be centrifuged was the first to pass through the pipes, and as a consequence, the uncentrifuged milk had preferable treatment prior to manufacturing, in the way of both temperature and chance of contamination; and this fact likely accounts for the cheese graded as No. 2. Subsequent figures indicate that the percentage of No. 2 cheese was not increased by the centrifuging treatment.

Following is the grading of centrifuged milk cheese as compared with noncentrifuged milk cheese made at one factory from December 1921 to June 1922, inclusive. The figures represent all cheese made by the two methods, that could be compared during this period. The milk for making these cheese was not mixed as was that for the experimental cheese.

Kind of cheese.	Number.	Grade.		
		Fancy.	No. 1.	No. 2.
		Per cent.	*Per cent.*	*Per cent.*
From centrifuged milk	241	77.6	7.1	15.3
From uncentrifuged milk	109	30.3	52.3	17.4

Several other factories report little trouble with No. 2 cheese where the milk is clarified or centrifuged, but a marked improvement in the quality as well as in the price of cheese by this treatment.

With certain gas-producing organisms of the *Coli aerogenes* type isolated from niszler cheese, a difference of 3° C. in the secondary heating was sufficient to check niszler or pressler tendencies in experimental cheese.

In some cases the use of oxygen gas has proven an effective means of checking niszler and pressler tendencies in experimental Swiss cheese where the milk was inoculated with a vigorous spore-forming anaerobe originally isolated from a niszler cheese. By the ordinary methods of making Swiss cheese this fermentation could not be controlled. The use of ozone in preliminary experiments indicates that it has a retarding effect upon this type of fermentation, but imparts an unpleasant flavor to the resulting cheese. The use of air by pumping it into milk inoculated with the same anaerobe failed to check this gassy fermentation.

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ABSTRACT.

THE RELATION OF LACTIC BACTERIA TO CHEESE RIPENING.

By Prof. Dr. CONSTANTINO GORINI, Director of the Bacterological Laboratory of the Agricultural High School in Milan.

The contribution which I bring relative to the question of bacteria (lactic) in regard to the ripening of cheese consists of the following demonstrations:

(1) That there exist acidoproteolytic lactic bacteria which are capable of peptonizing the casein in the acid medium which they themselves produce.

(2) That these acidoproteolytic lactic bacteria explain the process of cheese ripening for which there are not enough of the simple lactic bacteria which do not attack the casein in the acid medium.

(3) That these saccharolytic and proteolytic activities vary according to the condition in which they live (air, temperature, substratum, etc.) and are susceptible to sudden mutations by individual separation. The latter often render the determination of these bacteria difficult.

(4) That, nevertheless, these bacteria and their caseolytic enzymes (which rarely continue their activity after the death of the bacteria) are likely to function also at the lowest temperatures used in curing the cheese.

(5) That, in reality, with cheese, in all stages of ripening, one finds acidoproteolytic bacteria mixed among the cocci as among the bacilli. The cocci occur notably in the first stages, the bacilli in the more advanced stages.

(6) That the acidoproteolytic cocci of cheese exist normally in the mammary microflora, so that the milk of the animal already contains bacteria and bacterial enzymes necessary for the ripening of cheese.

(7) That these acidoproteolytic bacilli of cheese are of the sporific type *Subtilis* or *mesentericus*, which probably come from the forage, or in reality, by other means which I shall also relate. Through this I shall demonstrate at the same time the existence of sporigenous lactic bacteria.

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(8) The extent of the role these different types play in cheese; the simple lactic bacteria, being endowed with a high acidifying potential, serve especially to combat the dangerous fermentations, chiefly the butyric one; while the acidoproteolytic bacteria serve especially to soften the curd and hasten the ripening; both in the meantime serve to suppress the bitterness. As to taste and aroma, which are characteristic of certain peculiar types of cheese, I can say nothing definite. So that for the cultivation of pure cultures to inoculate the milk it is necessary, in principle, to use a mixture of simple lactic bacteria with acidoproteolytic bacteria; but on the subject of the single kinds of bacteria we should prefer, it is advisable to have a free hand in the choice of cultures.

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ABSTRACT.

CONTROL OF THE FERMENTATIVE PROCESSES IN ITALIAN CHEESE TYPES WITH PURE CULTURES.

By Prof. Dr. CONSTANTINO GORINI, Director of the Bacteriological Laboratory of the Agricultural High School of Milan.

The following is a short résumé of the research and experimental work conducted during the past 20 years on the rational manufacture of Italian cheese, by controlling the fermentative processes by the use of pure cultures, coupled with hygienic methods, in order to reduce the contamination of milk to the lowest possible minimum.

It was demonstrated, primarily by my experiments with respect to Grana or Parmesan cheese (1906), that by the use of pure cultures of selected ferments we can obtain a favorable influence on the resulting cheese, even under ordinary conditions and current practices.

The advantages we can derive are of two kinds: Fighting against detrimental fermentations and improving the intrinsic qualities of the curd by hastening the ripening. But I have also shown that the industrial value of these improvements is connected with different conditions which are narrowed down to three points: (1) The quality of the milk; (2) the quality of pure cultures; (3) the methods of using these cultures.

(1) *Quality of the milk.*—I have found that a milk may be ill adapted to the use of pure cultures for two reasons: By its detrimental bacteria, and by a variation in its fermentative and cheesemaking adaptabilities. As to the detrimental bacteria, we should fear their nature much more than their number. The most dangerous are the gas-forming bacteria, particularly the butyric bacteria, because they are the most difficult to control by pure cultures. These bacteria, as I have shown, appear in the milk, especially by poorly preserved forages, such as hays and silages, which have undergone butyric and putrefactive fermentations. To prevent such danger, I have studied ways of preparing hays and silages which I have called *lactic*. I have observed that we can obtain this by ensiling the half-dried hays and subjecting them to an early and energetic pressure in such a manner that the temperature of the fermentation will not exceed 50° C., and also, in several cases, by the inoculation with lactic acid bacteria.

As to the fermentative and cheese-making adaptabilities, milk may, without perceptible variations in its organoleptic characteristics, be unsuited for cheese making because of modifications in its chemicozymatic constitution, in its relation to rennet and its restraining or germicidal action. These modifications which can not be corrected by pure cultures are a result of secretory troubles induced by an abnormal mammary bacterial flora, which can create cellular reaction even without noticeable inflammation in the udder. To prevent the occurrence of such results by avoiding stagnation of milk in the udder, the milking must be done in a complete, proper, and correct manner.

(2) *Quality of pure cultures.*—It is advisable, in principle, to use a mixture of simple lactic bacteria, indicated by Freudenreich (which do not attack the casein in acid reaction), with my lacto-proteolytic ferments which render casein soluble even in acid medium. This is independent of their coccoid or bacillary form, for it is their function which counts.

(3) *Methods of using pure cultures.*—The milk, before being put into the vat, must be held at a very low temperature, possibly around 5° C., in order that the number of bacteria of all kinds, including both dangerous and favorable bacteria, be held as low as possible. It would always contain, nevertheless, a certain quantity of lacteoproteolytic bacteria which I have shown exist normally in the mammary bacterial flora and contribute to the ripening of the cheese. The inoculation of selected cultures serves to make up for the lack of other types of ferments.

During the working it is always necessary in each operation to carefully watch the manufacture of the cheese as if it were a matter of preparing a culture of caseous microbes.

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ABSTRACT.

THE CONNECTION BETWEEN THE BACTERIAL CONTENTS OF THE CHEESE MILK AND THE RAPIDITY OF THE RIPENING OF THE CHEESE.

By CHR. BARTHEL AND E. HAGLUND, Central Agricultural Experiment Station, Stockholm, Sweden.

One of us (Barthel) previously showed that the ordinary lactic acid bacteria belonging to the *Streptococcus lactis* group could decompose casein at temperatures usually employed in storing cheese (14°–20° C.) and that, therefore, a far more important part must be ascribed to the action of these bacteria in the ripening process of hard cheeses than has hitherto been done. Moreover, these lactic-acid bacteria are, during the first few months of ripening at any rate, absolutely predominant in the bacterial flora of the cheeses in question.

Attempts to influence the rapidity of the ripening of the cheese by the addition to the cheese milk of starters, consisting of cultures of lactic acid streptococci having different powers of splitting casein, were not successful. A probable explanation of this result lies in the circumstance that in these trials, although equal quantites of starter were added of the different strains, yet we had no knowledge of the actual total number of bacteria added. It certainly seems probable that the rapidity of the ripening of the cheese is directly dependent on the number of bacteria in the cheese milk at the moment of adding rennet. In order that the above trials with different bacteria should be really comparable with one another, it was, of course, necessary that the number of bacteria in the cheese milk at the moment of adding rennet should be the same in all cases.

In the first place, it was necessary to find out how a definite connection could be demonstrated between the total number of bacteria in the cheese milk on coagulation on the one hand, and the rapidity of ripening of the cheese on the other. We also made such investigations, and showed that a connection of this kind undoubtedly exists. By bacterial content we naturally mean the content of lactic acid bacteria. The rapidity of ripening of the cheese was determined in these trials by means of determinations of soluble nitrogen expressed

in percentages of the total nitrogen, carried out on samples taken at definite intervals.

That the rapidity of the ripening of cheese thus appears to be fairly directly dependent on the number of bacteria in the cheese milk is confirmed by practical experience, according to which it is considered possibe to influence the course of ripening by adding starters to the cheese milk or by letting the milk "ripen" to a certain degree of acidity. In both of these operations, of course, a large number of lactic acid streptococci are added. As we found the above-mentioned connection to exist we proposed to return to the investigation of the question as to how far it is possible, by the addition of strains of lactic-acid bacteria of different casein splitting powers to the cheese milk (pasteurized to 63° C. for 30 minutes), to influence the rapidity of the ripening of the resulting cheese.

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ABSTRACT.

THE USE OF SELECTED LACTIC FERMENTS IN THE MANUFACTURE OF HARD-PRESSED CHEESE.

By R. H. LEITCH, M. A., B. Sc., Professor of Dairying, West of Scotland Agricultural College.

USE OF STARTERS IN CHEESE MAKING.

In order to secure the desirable flavor and texture the cheese maker resorts to the use of a starter, which is simply a milk culture of certain lactic bacteria which grow quickly in milk.

The starters in common use at the present time are more or less pure cultures of *streptococcus lacticus*, of which there are two distinct though closely related species (1) *Str. lacticus* (diplococcus form) and (2) *Str. lacticus* (streptoccus form). Experiments in the use of both these starters have been carried out and the results obtained are noted.

The value of a starter, however, can not be correctly estimated by the morphological character of the typical organism, or by the common biological tests of the laboratory and it has been proved that strain is the most important factor. It has been found by experiment that a strain of *Str. cremoris* isolated from a sample of goat's milk gave an usually fine flavor to butter and cheese. The ability of a starter to remain pure under ordinary dairy conditions is also a most important feature and is largely a matter of strain.

Experiments have also been made in connection with starters of the *B. bulgaricus* type, which are in marked contrast to those of the *Streptococcus lacticus* type. Representatives of this group which have been made the basis of experiment are *B. bulgaricus* (Massol), *B. Frendenreich*, *B. bulgare* (from Pasteur Institute), *Bastonicini lactici coagulanti* (Gorini), *B. bulgaricus* (Samarani), *Streptothrix daphi* (Chatterjee), *Strepto-bacterium casir*, 11 and 32 (Jensen), *Bacillus acidophilus* (Browning), bacillus of Tarkhana, and the bacillus of Laban Ra-yeb. It was found that cheese made as described with the use of *B. bulgaricus* (Massol) as a starter possessed a texture equal to that of the best cheddar and a rich and characteristic flavor quite distinct from that of cheddar.

It was found that the degree of acidification of the curd is the factor which exercises the greatest control over the texture of cured cheese and experiments to ascertain the proper acidities were carried out and the results noted.

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SPECIAL PROCESS OF MANUFACTURE.

As a result of these experiments a cheese was manufactured which differed in some essentials from the cheddar and the Derby cheeses, and details of the process of manufacture are given. By this process a cheese of excellent texture and unusually fine flavor was produced, which, in an unrestricted market, will command a higher price than ordinary cheddar cheese.

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ABSTRACT.

BACTERIAL CONTENT OF GRANA CHEESE WHILE RIPENING.

By Dr. GIULIO DALLA TORRE, Instituto Sperimentale di Caseficio (Experimental Institute of Cheesemaking), Lodi, Italy.

The normal bacteria of Grana cheese do not differ very much from those of other cheeses of cooked curd, and, as in the latter, the bacilli, which prevail and last longer in cheese are the lactic bacteria, especially certain of the rodtype forms, some of which cause immediate coagulation of milk, and others slow coagulation or none at all, with only a very slight or no production of gas. Also, there are several cocci which develop a favorable action as they help to hasten the ripening of the cheese.

Concerning certain ferments injurious to cheese, the first ones to be mentioned are the bacteria of the *Coli-aerogenes* group. Their action in Grana, however, is greatly reduced, either by the high temperature of cooking or by the counteraction of lactic ferments, so that generally not a large percentage of waste should be attributed to these bacilli. The same may be said of butyric ferments and of other sporiferous anaerobes which, with the exception of rare cases due to bad milk or irrational treatment, we have always been able to find absent, or, if present, they occur in very small quantities. Much more frequent are some belated fermentations which produce in the cheese very irregular eyes, which are more or less marked and frequently accompanied by crumbling. These, however, do not cause noticeable changes in the taste or odor of the cheese.

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Abstract No. 57.

WORLD'S DAIRY CONGRESS, 1923.

ABSTRACT.

THE RIPENING OF CHEESE.

By F. W. J. BOEKHOUT, Director Bacteriological Department, State Agricultural Experiment Station, Hoorn, Holland.

We have dealt with the bacterial flora in freshly drawn milk and its giving place, for the greater part, to lactic acid ferments. The behavior of the latter in milk and fresh cheese and the chemical reactions to which the lactic acid gives rise were discussed. It was shown that in cheese the disappearance of lactose, beside the formation of an acid medium, is the main factor that causes a great number of bacteria to die off, whilst in milk it is the lactic acid that plays the principal part. We pointed out that the total change of the lactose in the cheese robs the lactic acid ferments of the necessary supply of carbon, thus causing the latter first to pass into a condition of latent life and then to die. Only the facultative rod-shaped lactic acid bacteria, i. e., those species which are able to convert lactose into lactic acid, but do not depend on this carbohydrate for their sustenance, continue to live.

The bacteriological process that takes place in cheese may therefore be summarized as follows: There is first a preinfection when bacteria get into the milk as it is drawn. This is followed by an intense lactic fermentation which stops the preinfection, but is after a short time arrested by want of milk sugar. After this only facultative lactic acid bacteria develop in the cheese. Other bacteria of normal occurrence have so far not been found in Dutch cheeses.

The influence which the different microorganisms may exercise in the ripening of cheese is as follows. Those that cause the preinfection are indeed soon destroyed, but manage to keep in a living condition for some time. They produce small quantities of proteolytic enzymes and may produce endo-enzymes. These two kinds of enzymes, though the quantity is small, may after some time exercise some influence on the body of the cheese.

The effect of the lactic acid ferments on the ripening process is very important. They exercise their influence in various directions. In the first place they cause the bacteria of the preinfection to succumb. Secondly, they sour the medium in a very short time, making it unfit for any putrifying bacteria. Thirdly, they make it possible

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for the enzymes in the rennet to exercise their influence. Besides these biological influences the lactic acid ferments exercise a chemical influence. The lactic acid acts on the calcium phosphates and the paracaseinates of the curd, and it is this action, joined to that of the salt, added in salting the curd, that gives a definite degree of softness to the cheese.

The rod-shaped facultative lactic acid ferments may help to convert the milk sugar into lactic acid in the beginning of the ripening process, and, as they remain in an active condition, continue their action afterwards; they seem to make the material of the cheese more plastic, but the exact nature of their action has not yet been ascertained.

Experiments with aseptically drawn milk have shown that a cheese-like product can be got by using lactic acid bacteria and facultative lactic acid bacteria, but that this product, though it looks like properly ripened cheese, lacks the characteristic taste and flavor of cheese. Nor does the addition of the bacteria which cause the pre-infection to the combination alter the result. From this we may conclude that the ripening consists of two successive or parallel processes, one of which is the development of the peculiar consistency of the cheese (caused by lactic acid ferments) and the other, the development of the flavor and taste.

Conditions effecting the lactic fermentation have been defined, but those which cause the development of taste and flavor are still the subject of hypotheses. Experiments have shown, however, that whatever the organism is, which brings about those latter qualities, it requires no oxygen and no milk sugar and that it can live in a sour medium and one containing a strong salt solution.

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U. S. Department of Agriculture.
Abstract No. 58.

WORLD'S DAIRY CONGRESS, 1923.

ABSTRACT.

SOME MILK TYPES CHARACTERIZED BY THEIR RENNIN REACTIONS, AND THEIR IMPORTANCE IN CHEESE MAKING.

By Dr. G. KOESTLER, Assistant, Swiss Dairy and Bacteriological Station, Liebefeld-Bern, Switzerland.

It may be concluded from experiments by O. Hammarsten that the rennin process takes place in two or more distinct phases, namely, the coagulation of the casein and the coagulation of the paracasein complexes. Under the first phase comes the gelatination of the liquid, which, with different milks, offers different reactions. These three "milk types" will be discussed briefly as follows:

Type A.—This type is characterized by a secretion that among the Swiss dairymen is called "rässalzig." This secretion is due to the by-products of udder bacteria. The reaction with rennin is such that the ordinary formulæ for the duration and speed of the gelatination are rendered useless.

Type B.—This type is little known to the industry, probably because its chemical composition, according to common milk tests, appears normal, and with the exception of its characteristic reaction to rennin, it would play no noteworthy part in cheese making. Under ordinary conditions the "coagulation phase" does not seem to take place, although the cheese has seemingly been prepared in the usual way. Acidification does not help the reaction, but the addition of small amounts of calcium chloride causes coagulation immediately. The same may be accomplished by the addition of a little curdling milk, consequently this type does not offer much difficulty for the cheese maker.

Type C.—This type is notably unfavorable for the manufacture of Emmenthaler cheese. Because of many similarities to the previous type it might be confused with Type B except for one distinct difference, the time of coagulation is more prolonged. In all cases the gelatination is abnormally retarded and the gelatinous liquid, once formed, remains much longer in a semiwatery state. The addition of rennin jelly will produce coagulation, but only after two or more times the ordinary length of time required. The increasing of the

acidity by the addition of calcium chloride and more rennin (concentrated) will correct this defect in the milk.

This type of milk is difficult of detection when mixed with normal milk; only after exhaustive rennin tests can its presence be definitely determined. And in these tests it is not so much the length of time necessary for coagulation, but the rapidity and the type of the gelatinous formation.

This type of milk is found to come from cows in the prime of lactation and for that reason its influence on cheese making is of no small importance.

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Abstract No. 59.

WORLD'S DAIRY CONGRESS, 1923.

ABSTRACT.

INFLUENCE OF THE ACIDIFICATION OF MILK ON THE WATER CONTENT OF WHITE CHEESE.

By Dr. JOSEF PROKS, Assistant at the Institute of Dairying, Prague, Czechoslovakia.

From observations made on cheese made from skimmed and pasteurized milk it has been demonstrated that the fermentation of milk has an influence upon the amount of water in white cheese. While the lactic bacteria of the type *B. lactis acidi* give a normal percentage of water in white cheese, *Bacteria coli* fermentations generally produce a very watery curd, and butyric fermentations cause very dry white cheese.

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Abstract No. 60.

WORLD'S DAIRY CONGRESS, 1923

ABSTRACT.

EXPERIMENTS IN THE MANUFACTURE OF RENNET ON AN EXTENDED BASIS.

By R. H. LEITCH, M. A., B. Sc., Professor of Dairying, West of Scotland Agricultural College.

Experiments on the manufacture of rennet, and its production on a large scale basis (rendered necessary by the circumstances of war), were carried out by the dairy research department of the West of Scotland Agricultural College for three successive years. The 3,000 gallons of rennet thus made were issued to the dairy industry of Scotland and gave excellent results.

PREPARATION OF THE RAW MATERIAL.

Rennet makers use the cured vells of commerce which are chiefly of continental origin. These vells, however, frequently harbor bacteria of the most undesirable type, which are a common source of faults in cheese. Superior results may be got by the systematic treatment of material of local origin. As soon as possible after slaughter the fourth stomachs of young calves are severed from the entrails. The mesenteric membranes and the adhering fatty tissue are carefully removed, the liquid contents of the stomach expressed, and the stomach lightly dry salted and inflated. The distended membranes are rapidly air dried and kilned for a further period. After curing, the dried vells are cut up with a machine and added to the extracting fluid.

PROCESS OF EXTRACTION.

The composition of the extracting fluid is of first importance. A simple extraction with brine of regulated strength gives good results, but a combined salt and calcium chloride extraction is more effective. A few crystals of thymol may be added to control the fermentation during the period of steep, but this should only be necessary with second-class vells. It is important that the extracting fluid be kept near the neutral point, as this limits the amount of slime appearing in the extraction. The temperature of extraction should be relatively low (10° to 15° C.). When the extract has gathered sufficient strength, the extracting fluid is decanted. The exact time of decantation is of critical importance from the point of view of the force and subsequent keeping qualities of the rennet. The normal period of steep lies between 10 and 20 days.

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METHODS OF CLARIFICATION AND PRESERVATION.

The extract, when very slimy, may be partially clarified by centrifugalization or by filtering through calico. The fluid is then additioned with glycerine and salt until the salt content reaches 14° Baumé. Boric acid, if not previously added, is mixed with the glycerine and added with the salt. The extract is now allowed to sediment. In from 20 to 30 days' time the clear rennet may be siphoned off and stored away. If the extract does not clarify after an interval of 3 or 4 weeks it should be filtered through a special filter. Most rennet extracts are colored with a salt-saturated caramel solution. Rennet should be stored in stone jars or held in bulk at a low temperature, and oxidation should be guarded against. Free exposure to air undoubtedly increases the loss during keeping.

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U S. Department of Agriculture.
Abstract No. 61.

WORLD'S DAIRY CONGRESS, 1923.

ABSTRACT.

THE FLORA OF AMERICAN CHEDDAR CHEESE AND ITS RELATION TO QUALITY.

By G. J. HUCKER, New York Agricultural Experiment Station, Geneva, N. Y.

In Cheddar cheese, as in other varieties of cheese, the flora of the ripening curd plays a large rôle in the production of a desirable or undesirable product. The only control upon this flora which has been used in practice has been the addition of lactic acid starter (*Strep. lactis*) and the curing of the cheese under conditions of temperatures, moisture, etc., which have been found by years of practice to give the most desirable results. Following such a procedure, it is evident that the ultimate quality of the ripened product depends largely upon the flora of the milk to be made into cheese. The improving of the quality of American Cheddar cheese can be brought about either by producing milk which contain as few organisms as possible, the desired flora being added as a starter, or, rather, by certain manipulations in the dairy to produce milk which will contain the proper flora for the insurance of Cheddar cheese of a high quality. To follow either of these procedures successfully, more should be known regarding the flora of Cheddar cheese and the relation of such flora to its quality.

With such information at hand it becomes necessary to determine which groups of organisms are associated with the better grades of Cheddar cheese and which are characteristic and probably accountable for the large amount of poor quality cheese found in our local markets.

The New York Agricultural Experiment Station has recently completed additional floral studies of cheese, isolating the oragnisms from 37 samples purchased on the retail market. The samples were from all grades of Cheddar cheese and were separated into three classes according to quality. In all, 265 cultures were isolated and studied and arranged in the following groups: (*a*) Spore-formers, (*b*) Gram-negative rods, (*c*) lactobacilli, (*d*) *Strep. lactis*, (*e*) cocci, (*f*) streptococci. The above are given in order of frequency of occurrence.

The flora of the poorer grades of cheese is composed largely of spore forms and Gram-negative rods with a few representatives of the other types, while the better quality samples yielded cultures largely belonging to the lactobacillus and coccus groups. Large numbers of *Strep. lactis* strains were found in all samples.

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WORLD'S DAIRY CONGRESS, 1923.

ABSTRACT.

EDUCATIONAL AND ADVISORY WORK IN DAIRY FARMING THROUGH THE AGENCY OF MILK-RECORDING SOCIETIES.

By G. H. GARRAD, N. D. A., Agricultural Organizer, Kent County Council, and JAMES MACKINTOSH, O. B. E., N. D. A., N. D. D., National Institute for Research in Dairying, Reading, England.

This paper describes briefly the organization and progress of milk-recording or cow-testing societies in England and Wales through the national scheme initiated by the Ministry of Agriculture, and how investigations by agricultural colleges into the feeding of dairy cows brought to light a great variation in practice and showed the need for systematic advisory work among dairy farmers on this subject.

The methods by which such advisory work is combined with the work of a milk-recording society are described, and several examples are given of the direct saving accruing to farmers from participation therein. The probability of very great extension of this work is indicated and the educational advantages to the farmer in particular and the dairy farming industry in general are emphasized.

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Abstract No. 63.

WORLD'S DAIRY CONGRESS, 1923.

ABSTRACT.

MILK RECORDING IN SCOTLAND.

By WILLIAM STEVENSON, B. Sc., N. D. A., N. D. D., Superintendent, The Scottish Milk Records Association, Ayr, Scotland.

Milk recording, on a public basis, has been carried on in Scotland for over 20 years, and has proved one of the most important means of increasing milk production and improving the quality of milk on the most profitable lines, and of enhancing the commercial value of good milking animals and their progeny. A natural progression has taken place from records intended mainly for the private use of the herd owners to fully authenticated milk records accepted without question by the general body of breeders and buyers.

A distinctive feature of milk recording in Scotland is that the records are entirely the work of trained official recorders who must first undergo a special course of training in an approved college of agriculture.

Dairy farmers taking advantage of the scheme are arranged into local milk-recording societies. Grants are allocated to local societies on a definite scale.

The official recorder weighs and samples the milk of each cow evening and morning, receiving the milk direct from the milker at the cow's side, and tests the samples by the Gerber method for percentage of milk fat. Each cow must be indelibly tattooed on the ear with registered markings. The recorder completes the byre sheet and milk record book, multiplying the yields by the exact number of days from the last test, generally about 21 days, but so calculating throughout that each day of visit is regarded as the middle day of the period covered by the test. All byre sheets and record books are carefully revised and corrected in the association's offices.

Another distinctive feature in Scotland is the surprise check tests, systematically arranged by the superintendent. The recorder is instructed on any date to remain at the same farm another day and make a second complete 24 hours' test. Any abnormal difference is immediately noted and reported to the executive committee. As a result of the surprise check tests each page of the milk-record book

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contains two or three lines of entries in red ink, comparison of which with the immediately preceding entries provides valuable evidence as to genuineness of the milk record.

In addition to the surprise check tests made by the official recorders, visits of inspection and independent surprise tests are made by the association's staff to check the recorders' work.

The association publishes an annual report giving full details of its work, including a register of good milking, or Class I, cows. The register is restricted to animals which produced another calf before May 1 of the year following.

The number of herds being officially tested in Scotland in 1923 is 703, and the number of cows 28,486.

Good progress has been made in eliminating the poor milking and increasing the good milking cows, and the average milk yield per cow. An improvement is also noticeable in the average milk fat percentage. The proportion of good milking, or Class I, cows and heifers to the total animals tested has increased from 39½ per cent in 1914 to 63 per cent in 1922, while the proportion of obviously unprofitable, or Class III, animals, has been reduced in the same period from 9 per cent to 2 per cent. Stock bulls from good milk record strains have been widely distributed in Scotland among tested and untested herds, and a large number have been exported.

Official milk records have had a remarkable effect on the prices of good milk record cows and their progeny. A new standard of judging dairy cattle at cattle shows in Scotland has been adopted whereby a maximum of 35 points out of a total maximum of 100 points are reserved for allocation according to a definite scale for authenticated milk yields.

In 1924 the association will introduce a new scheme of private or unofficial milk records for unregistered herds, under which the dairy farmer may become his own recorder. The object is to establish milk recording on a wider and more popular basis. The ideal before the association is to have every dairy herd in Scotland included in one or the other of the association's two schemes of recording.

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WORLD'S DAIRY CONGRESS, 1923.

ABSTRACT.

METHODS ADOPTED IN ENGLAND AND WALES TO CONVEY DAIRY EDUCATION AND THE PRINCIPLES OF CO-OPERATION TO THE FARMER.

By J. F. BLACKSHAW, O. B. E., Dairy Commissioner, Ministry of Agriculture and Fisheries, Great Britain.

The paper is prefaced by a brief description of the conditions of dairy farming in England and Wales to-day. Until fairly recently whole milk was produced in close proximity to the large consuming centers and important dairying districts away from such centers marketed their milk in the form of cheese or butter. The development of railway transport and the growing of urban populations have wrought great changes, and now probably 50 per cent of farms devoted to milk production were until recently otherwise employed. The older or "original" dairy farms are generally provided with structural conveniences for the manufacture of dairy produce and are farmed by persons who have for generations been accustomed to the manufacture of milk products. In the case of recent farms these happy conditions do not exist, and the need for technical instruction is, of course, more urgeut.

Country milk depots in considerable number collect and treat milk for transport to the towns and also manufacture milk products. Many of these depots are owned and managed by cooperative societies or farmers. The bulk of milk sold, however, is still dispatched direct to the consuming centers by the producers.

An outline of the dairy-education scheme in operation in the country is then given. For purposes of convenience the scheme is divided into the following headings:

1. Pioneer lectures consisting of one to six meetings at centers convenient to country audiences.
2. Exhibits, demonstrations and lectures at agricultural shows.
3. Improvement of the smaller dairy herds by the formation of bull clubs.
4. Improvement of milk yields by the formation of milk-recording societies.

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5. Advisory work in feeding and management of dairy stock.
6. Courses of instruction in clean-milk production.
7. Traveling butter-making schools.
8. Traveling cheese-making schools.
9. Cooperative dairy schools.
10. Fixed junior and senior dairy courses at county farm schools or institutes.
11. Higher courses in dairying at dairy colleges.
12. Dairy research at the National Dairy Research Institute.

Each head is discussed briefly, and the respective spheres of the state department (the Ministry of Agriculture), the agricultural colleges and farm institutes, and the county education authorities are pointed out.

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WORLD'S DAIRY CONGRESS, 1923.

ABSTRACT.

THE WORK OF A DAIRY INSTRUCTRESS IN ENGLAND AND WALES.

By Miss D. G. SAKER, N. D. D., B. D. F. D., Head of Dairy Department, Cannington Court Farm Institute, Somerset, England.

The work of a county dairy instructress, as carried on in England and Wales, may be divided up into five sections:

1. Lectures and demonstrations.
2. Traveling or itinerant classes:
   - (*a*) Milking classes.
   - (*b*) Butter-making classes.
   - (*c*) Cheesemaking classes.
3. Temporary schools:
   - (*a*) Farm house schools.
   - (*b*) Cooperative cheese schools.
4. Advisory visits.
5. Permanent dairy schools at farm institutes.

The lectures and demonstrations may be taken as the branch of the work which breaks the ground for future instruction. Topical lectures and demonstrations of subjects of local interest, either in villages or at agricultural shows, attract attention and tend to invite the solicitation of assistance.

Traveling or itinerant schools reach the class of county dweller who either is unable or does not wish to go away from the district, and supplies information at the very door. The classes are so arranged, as regards time and type of instruction given, that they meet the particular demand of the district where they are held. The expense of attending is practically nil and the work is, therefore, of great value to the struggling small holder. Temporary schools are usually only held in dairying districts where a fairly large amount of milk is produced. These schools show how to make the best article (generally cheese) and also how to prevent waste during the surplus season of the year.

Advisory visits.—Visits of advice are probably the branch of the work which shows results quicker than any other from a financial point of view. A farmer may be turning out a moderately good cheese but if he can be shown how to improve that cheese so that the

price is 10 shillings a hundred weight more and the yield from the milk at the same time increased, say 10 per cent, then he will be the first to advocate that system of instruction.

Permanent dairy schools should primarily supply the need for instruction among the younger generation, and should, as regards the agricultural population, be the finishing school for them. A thorough training in all branches of dairy work for anyone who is to live or work on a dairy farm is of the utmost importance and tends to make the life more interesting and thus prevent the craving for the many interests in the town.

Permanent schools also should be centers where help and advice can be obtained at all times, both by correspondence and personal visits, and, if the center of all work carried on in that particular district, they can be of great help to the staff who are working at the various branches of instruction previously mentioned.

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U. S. Department of Agricultre.
Abstract No. 66.

WORLD'S DAIRY CONGRESS, 1923.

ABSTRACT.

TASK OF THE GOVERNMENT DAIRY EXPERTS WITH REGARD TO MATTERS OF DAIRYING.

By Dr. A. J. SWAVING, Inspector of Dairying, Chief of Dairy Division of the General Direction of Agriculture, Ministry of Home Affairs and of Agriculture, The Hague, Holland.

In the Netherlands there are at present 10 government dairy experts and 1 assistant government dairy expert with a staff of 4 head assistants and 6 assistants, namely, in each Province one government dairy expert or assistant government dairy expert, however, with the proviso that 2 government dairy experts are appointed in the Province of South Holland; whereas in Friesland, the organizations interested have a short time ago supplied the want of enlightenment by means of their own staff.

The expert's task comprises: to enlighten associations or private persons at farms and dairy factories concerning butter and cheese making and sometimes concerning cattle breeding; to give instruction at several agricultural winter colleges, at courses for the education of agricultural teachers, at courses in agricultural instruction as well as at a very great number courses in milk examination, theoretical and practical butter and cheese making and courses for the education of assistant managers, headmasters of dairy factories, milk controllers, butter and cheese makers; to hold lectures, which are accessible to every one, free of charge; to give assistance to the preparation and execution of measures or of experiments of general importance (barn competitions, grading of butter and cheese, milking competitions, etc.); to make simple tests concerning dairy products to trace defects of butter and cheese.

Though also at other places, the dairy experts in the Provinces of Utrecht and North Holland, and in the eastern part of the Province of South Holland, in particular, are occupied in giving theoretical and practical instruction in order to improve cheese making and eliminate cheese defects and other working troubles. The instruction of these experts is, besides, of great use, when cheesemakers meet with difficulties as to the observance of the regulations of cheese-control stations.

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The care for the improvement of milk production is considered by the government dairy experts everywhere most diligently and they supervise, at the same time, the work of the breeding and cow testing associations with respect to milk control (milk lists).

In conclusion it may be mentioned that, in the interest of mutual contact, as well as to remain in touch with the Government, one or two meetings are held annually by the dairy experts under the direction of the inspector of dairying of the direction of agriculture.

On these occasions different subjects concerning the work and the sphere of activity of the dairy experts are discussed and questions concerning matters of dairying and cattle breeding are looked into.

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U. S. Department of Agriculture.
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WORLD'S DAIRY CONGRESS, 1923.

ABSTRACT.

AGRICULTURAL EXTENSION METHODS AND ACTIVITIES.

By A. A. BORLAND, Professor of Dairy Husbandry, State College, Pa.

Agricultural extension work consists in the instruction of those who are not resident students at an educational institution.

The Smith-Lever Act, May 8, 1914, provided for a permanent national system of extension in home economics and agriculture.

Agricultural extension work is directed for the Nation by the United States Department of Agriculture, for the State by the extension service of the State agricultural college, and for localities by county extension representatives usually known as county agricultural agents. The people in the various community centers in the county are responsible for determining with the county agent the lines of agricultural improvement to be undertaken, and the methods to be employed.

Cooperative bull associations in which a number of superior sires are owned cooperatively and rotated from block to block of the association every two years have mostly been organized by agricultural extension workers. These associations are especially valuable to breeders having small herds that individually do not warrant the maintenance of an expensive sire. On July 1, 1922 there were 190 bull associations in the United States with 6,102 members owning 857 sires.

The extension service has been largely responsible for the increase in cow testing associations. With association records as a basis for culling, many unprofitable cows have been eliminated. The average yield of milk for the cows on farms in the United States according to the 1920 census was 3,148 pounds, while for the 21,234 cows in the testing associations the average milk yield was 6,077 pounds.

The introduction of pure-bred cows as foundation stock for pure-bred herds has been an important service. The records from 1,420 cows in testing associations in one county in Pennsylvania show that the pure-bred cows produced 17 per cent more milk and 15 per cent more butter fat than the grades. Since less than 3 per cent of the dairy cattle in the United States are pure bred there is room for continued effort.

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To the boys and girls club work may be credited a considerable amount of the constantly increasing interest in improved livestock. Calf growing clubs have been especially productive of beneficial influences not only to the boys and girls but to their parents as well. Nearly 9,000 boys and girls have been engaged in club work during the past year.

Instruction in the use of properly balanced and economical rations has been one of the important functions of the extension service. Ration meetings, feeding schools, conference with feed dealers' associations, and the publication of monthly feed news circulars are some of the means used to encourage better dairy cattle feeding.

Much progress is being made in the prevention and control of animal diseases through the cooperation of county, State and Federal agencies. Under the disease free area plan county wide campaigns have been carried out which have elimnated nearly all the tubercular animals in certain counties. During the year 1,065,098 animals were tested for tuberculosis.

Campaigns for better quality in dairy products have been instrumental in improving the sanitary conditions of milk and cream delivered by producers. The consumer has thus been better satisfied, the demand for dairy products has been increased, and the dairyman himself has received a higher price for his product.

The extension representatives, while not permitted to act directly as buying and selling agents may properly give such instructions and advice as will enable farmers to organize effectively their own marketing organizations. In the territory adjacent to large milk consuming centers, producers organizations dispose of the milk for their members. In many small cities farmers cooperative milk plants handle the product. Cooperative creameries and cheese factories are common in the rural districts.

Campaigns for the increased consumption of milk and other dairy products have been fruitful in bringing to the attention of consumers the high food value of milk. During the past year campaigns in 10 of the larger cities resulted in increases in the consumption of milk ranging from 15 to 25 per cent.

The beneficial results of agricultural extension work will no doubt increase as the improved methods of production and marketing taught by extension workers become more generally adopted throughout the Nation.

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U. S. Department of Agriculture.
Abstract No. 68.

WORLD'S DAIRY CONGRESS, 1923.

ABSTRACT.

METHODS OF DISSEMINATING RESULTS OF RESEARCH INFORMATION CONCERNING THE DAIRY INDUSTRY BY PUBLICATIONS.

By J. H. FRANDSEN, Editor in Chief, Journal of Dairy Science, and Dairy Editor, Capper Farm Press, Lincoln, Nebr.

"Why do Americans print bulletins of every description instead of using the world's accepted scientific journals for the dissemination of research information?" is a question often asked by scientific workers from abroad.

The author ventures the suggestion that the provisions of the Hatch Act, under which agricultural investigation in this country had its inception, are largely responsible for this practice. The Hatch Act provides for the establishment of agricultural experiment stations and decrees that bulletins or reports of progress shall be published as often as once in three months, and these be distributed to farmers and newspapers. All detail as to subject matter, style, size, etc., is left to the discretion of the director of the station and his staff.

When we remember that we are a Nation of 48 States, each one operating to a very large extent independent of the others, we can account for the striking variation both as to classification and subject matter in the many bulletins issued by the various stations in this country.

Then too, agricultural college workers in the United States do not consider it a mistake to frame their bulletins so as to make them intelligible to the general public. Many feel that such effort will make clearer and more applicable the findings of these investigations, and since the stations are supported largely by popular taxation, many directors feel that it is quite essential to keep in touch with their constituency by means of bulletin material in order to maintain popular interest and to get support and adequate appropriations.

The number and variation in style of bulletins and resultant confusion have grown to such an extent that American stations and agricultural colleges are already making concerted efforts toward standardization and uniformity of all their publications. With but few exceptions we find that our land-grant colleges now have agreed upon three types of publications:

(1) Research bulletins. These are technical in nature, cover only work done at the station, and are sent only to scientific workers at home and abroad.

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(2) Station bulletins, which could appropriately be termed "popular bulletins." These give results of research work with or without technical data upon which conclusions are based, and may be a review of a research bulletin or an original publication.

(3) Extension bulletins, sometimes called "Experiment station circulars." These are generally limited to a popular but accurate discussion of some problem important to the State's agricultural interests, boys' and girls' club work, or household conveniences, and need not be based on strictly scientific work.

The United States Department of Agriculture publishes what is known as Farmers bulletins, which are written primarily for farmers. The department also publishes a series known as circulars, which are generally brief reports of scientific research and available to scientific workers.

The dairy research men of the department frequently use the Journal of Dairy Science, which is the official organ of the American Dairy Science Association, and the Journal of Agricultural Research, a weekly publication issued jointly by the Association of Land-grant Colleges and the United States Department of Agriculture in reporting their work. The Journal of Bacteriology and the chemistry journals are, of course, also used for articles of a special bacteriological or chemical nature.

Much dairy information of a semipopular nature appears in the trade or professional dairy papers, such as Hoard's Dairyman, of Fort Atkinson, Wis., and The Dairy Farmer, published by the Meredith Publishing Co., of Des Moines, Iowa, and in the regular farm press. The various breed papers, such as the Jersey Bulletin, the Holstein-Friesian World, the Guernsey Breeder's Journal and the Ayrshire Digest publish information of particular interest to breeders of purebred dairy cattle.

Data of peculiar interest to manufacturers of dairy products finds an outlet in trade papers, such as the New York Produce Review; the Chicago Dairy Produce; the Butter, Cheese and Egg Journal, of Milwaukee, Wis.; the Creamery and Milk Plant Monthly, of Chicago; the Ice Cream Trade Journal, of New York, and the like.

At present the tendency in most of our best stations is toward the use of the standard research journals as vehicles for scientific papers and for reports of progress, publication in them being simultaneous with, or even previous to, the appearance of the material in bulletin form. In fact, this trend toward the use of scientific journals is so pronounced that the author believes that in the near future all our best dairy research will be available in scientific journals.

In order that you may have opportunity to visualize what I have attempted to explain in the few minutes allotted to this subject, I have collected and brought here copies of the various types of bulletins, circulars, and posters published by our leading experiment stations. In this exhibit you will also find samples of scientific and trade journals mentioned in this paper.

[62403]

WASHINGTON : GOVERNMENT PRINTING OFFICE : 1923

U. S. Department of Agriculture.
Abstract No. 69.

WORLD'S DAIRY CONGRESS, 1923.

ABSTRACT.

DAIRY INSTRUCTION GIVEN BY THE COOPERATIVE DAIRY ORGANIZATIONS IN THE NETHERLANDS.

By J. A. GELUK, Secretary of the General Netherlands Dairy Union, The Hague.

A rather important part of the instruction of the subordinate staffs of dairy factories in Holland is given by the provincial organizations of cooperative dairy factories and the federation of these organizations, namely, the General Netherlands Dairy Union.

Independently, or sometimes in cooperation with the Government dairy experts, the different provincial organizations offer courses of instruction for assistant directors of butter factories, buttermakers, cheesemakers, separator operators, engineers or mechanics, and testers for factories or for cooperative cow-testing organizations.

Under the auspices of the General Netherlands Dairy Union, examinations are held annually for procuring certificates in the above-mentioned industrial branches. Although the courses given are not directly connected with these examinations (attendance in a course is not a requirement for admission to the examinations) it is through these courses that an insight into the nature of the examinations is obtained.

Only those persons are admitted to the examinations who have been engaged in practical work for a prescribed period of time. It is required that the applicant has actually been engaged in that branch of factory work for which he is taking an examination. For an assistant director, a buttermaker and a cheesemaker two years of practical experience are required. For a separator operator, or for a tester in a factory or cooperative association, one year's work is necessary and for a mechanic, three years.

The candidates for examination have to present a testimony that they have given practical evidence of being able to fill, independently, the position for which they desire a certificate. This evidence must be signed by a person from the factory where the candidate has been employed, who has observed the applicant on behalf of the examining board.

Persons wishing to take any of the examinations for assistant director of a butter factory, buttermaker, cheesemaker, or engineer

must be at least 20 years of age. To obtain certificates for separator operators, milk testers for a factory or cooperative control association the age requirement is 18 years at least.

In general, for all certificates it is required that the candidate be able to explain the various phenomena occurring in the different manufacturing processes; he must also show signs of sound, practical judgment.

The candidates, furthermore, must know the proper arrangement of the rooms in which they are to work, the employment of the various tools and utensils used in the different classes of manufactures, as well as how these articles should be handled and cleaned. Besides this the candidates must possess an adequate general education suitable for the work for which they desire a certificate.

The examination for an assistant director of a butter factory consists of five parts: (1) The testing of milk and its products; (2) separating and pasteurizing; (3) buttermaking; (4) bookkeeping, dairy organizations, and laws important to the buttermaker; (5) machinery and engine room. For the buttermaker the examination consists of three parts: (1) Milk and the testing of milk and milk products; (2) cream; (3) butter.

The cheesemaker is examined on milk and the testing of milk and its products and the making of cheese. The separator operator is examined on milk and the testing of milk and its products, and on separating and pasteurizing milk. Examinations for milk testers (controllers) in a dairy factory include the testing of milk and its products (as to quality and content), cow testing, and butter and cheese testing (cheese testing is optional).

The certificate of controller in a cow-testing association includes examinations covering the testing of milk and milk products (as to content) and operation of cow-testing associations. The engineer or mechanic is examined on the generation of steam, the operation of steam engines and auxiliary engines, the installation of refrigerating plants and the principles of electrical equipment.

It may be observed that the difference between the requirements for the assistant director's certificate and those for the other positions serves to indicate that the former position necessitates more exhaustive study than do the others.

[62805]

WASHINGTON : GOVERNMENT PRINTING OFFICE : 1923

U. S. Department of Agriculture.
Abstract No. 70.

WORLD'S DAIRY CONGRESS, 1923.

ABSTRACT.

THE NUTRITIONAL VALUE OF MILK.

By E. V. McCOLLUM, Professor, Department of Chemical Hygiene, Johns Hopkins University, Baltimore, Md.

The lecture will present the developments in animal experimentation in nutrition which led to a desire to test on children the question of the adequacy of a diet consisting essentially solely of cereals, peas, beans, tuber and root vegetables, white flour, and muscle meats. An institution was selected in which a large number of orphan children had been fed for some years on this type of diet. An opportunity was secured to make a demonstration with certain of these children of the beneficial effects of modifying the diet by the inclusion of suitable amounts of milk. The results of the demonstration fully corroborate the deductions which had been earlier drawn from the results of animal experimentation.

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WASHINGTON : GOVERNMENT PRINTING OFFICE : 1923

U. S. Department of Agriculture.
Abstract No. 71.

WORLD'S DAIRY CONGRESS, 1923.

ABSTRACT.

MILK AS A FOOD.

By Dr. LA FAYETTE B. MENDEL, Professor of Physiological Chemistry, Yale University and Research Associate Carnegie Institution, Washington, D. C.

Milk has long been recognized as a product possessing unique nutritive value. In explanation of its rôle as a food, attention was early directed in a general way to the familiar foodstuffs—the proteins, fats, and carbohydrate—which it contains. To these was added the consideration of the unusual make-up of milk with respect to its inorganic ingredients. The richness in calcium and phosphorus have deservedly received particular emphasis.

The newer investigations in the science of nutrition have directed attention to other aspects of milk as a dietary component which could scarcely have been suspected a few years ago. Foremost among these is the presence of a group of hitherto unidentified dietary essentials now commonly referred to as vitamines. The food factors frequently designated as vitamines A, B, and C have been shown by physiological experimentation to occur in milk. Among these the antiscorbutic potency (the vitamine C) of milk has been recognized for some time; and inasmuch as it is somewhat easily destroyed through exposure to certain environmental changes involving rise in temperature and perhaps oxidation, this feature has been widely discussed in connection with the pasteurization and sterilization of milk and its products. Latterly there has been discussion of other potencies of milk which may play a part in the proper development of the structures involved in the capacity to breed. There is considerable misunderstanding and widespread misstatement about the comparative thermolability of the different vitamines and their resistance to changes in their chemical environment. The current information in this field which has an obvious bearing on many branches of the milk industry should be subjected to critical review in the interest of accuracy and progress.

The proteins of milk have been made the subject of considerable study with respect to their so-called nutritive "quality." No less than four distinct proteins have been identified in cow's milk. Much remains to be ascertained as to their precise chemical make-up. Casein affords an illustration of some of the possibilities of structural

peculiarity. It is a phosphoprotein; it does not yield glycocoll on hydrolysis and it is comparatively poor in the sulphur-containing amino acid complex represented by cystine. Of considerable dietary importance is the fact that the milk proteins afford, in general, a good protein supplement to the cereals which are generally so conspicuous in the dietary of man. Several relative deficiencies of the cereal grains are averted by the use of milk with these.

The possible physiological properties of milk sugar remain to be elucidated. Recent studies in intestinal bacteriology have attributed special efficacy to this carbohydrate in promoting the survival of an acidophilic flora and consequently in repressing the development of putrefactive types of microorganisms in the gastro-intestinal canal. Large problems in connection with the relations of bacteria, "soured" milks, and various milk products to alimentary conditions are here presented. There has been much exaggerated statement and misrepresentation in regard thereto.

The physiological potencies of colostrum as a carrier of antibodies to the newborn have received new consideration lately.

The possibilities of milk and some of its numerous products from a culinary standpoint deserves more emphasis than has been given to them hitherto. The propaganda to "drink more milk" meets with real or fancied limitations in some persons. It is, however, often agreeable or advantageous to increase the intake of certain ingredients of milk by the use of products other than fluid milk. Herein lies the opportunity for the introduction of some of the increasing varieties of milk-made foods.

[62279]

WASHINGTON : GOVERNMENT PRINTING OFFICE : 1923

U. S. Department of Agriculture.
Abstract No. 72.

WORLD'S DAIRY CONGRESS, 1923.

ABSTRACT.

MILK IN THE TROPICS.

By Colonel R. I. BLACKHAM, C. B., C. M. G., C. I. E., D. S. O., M. D., M. R. C. P. E., D. P. H. (London).

In tropical countries the chief source of milk is the buffalo, whilst the cow, goat, and sheep are subsidiary sources of supply. Except under Government control, no systematic breeding of cows or buffaloes exists. Nevertheless, India exports milch cattle to all parts of the Tropics.

The analyses of cow and buffalo milk obtained by the author during a long experience in India are given.

The present retail distribution of liquid milk in the Tropics is dealt with, and means are suggested for dealing with the scarcity of milk and the consequent high price in certain parts of the Tropics. Various economic and educational measures for the reform of tropical milk supplies are suggested, and recommendations are made for the care, management and housing of milch cattle, for securing clean milking, and for the storage of milk in the Tropics by the consumer.

The uses of condensed and dried milks in the Tropics are considered, and it is shown that, where cow's milk is unobtainable and goat's milk dangerous, dried milk has a wide range of application. The food of milch cattle in the Tropics is mainly parched grass and dried lentils and, consequently, their milk is lacking in vitamines, and compares unfavorably with dried products prepared from the milk of animals fed on rich pasturage.

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WASHINGTON : GOVERNMENT PRINTING OFFICE : 1923

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U. S. Department of Agriculture.
Abstract No. 73.

WORLD'S DAIRY CONGRESS, 1923.

ABSTRACT.

THE OPTIMUM AMOUNT OF MILK FOR CHILDREN.

By H. C. SHERMAN, Professor of Food Chemistry, Columbia University, New York City.

In view of the fact that some advocate a quart of milk per day for every child while others believe that a smaller amount may do as well, the New York Association for the Improvement of the Condition of the Poor, with the cooperation of the Department of Chemistry of Columbia University, undertook an extended series of experiments upon children from 3 to over 13 years of age, to determine what quantity of milk per day, taken as a part of a normal diet, would induce the best storage of calcium and phosphorus in the body of the growing child and hence, presumably, the best development of bones and teeth. The investigation was made possible by a grant from the research fund established by Mrs. Elizabeth Milbank Anderson. The experiments were conducted by Miss Edith Hawley under the general direction of the writer.

Groups of average children were taken from city homes to the suburban house maintained by the association where they lived normally for periods of from 10 to 50 days under the constant personal supervision and control of the research worker (Miss Hawley), who slept in the room with the children, prepared their food, and recorded and analyzed the complete food intake and excretory output of each child separately throughout its experimental period.

The investigation was divided into four progressive series of experiments including in all 21 children between the ages of 3 and 14 years and covering a total of 417 experimental days.

In the first series of experiments the children received an ordinary mixed diet containing 750 grams (about three-fourths of a quart) of milk for each child daily, this being about the amount they were supposed to have had at home. This diet resulted in their storing calcium in small quantities approximately proportional to their body weights. In the second series when the amount of milk was increased to 1,000 grams (1 quart) of milk per child per day, the storage of calcium was materially improved. Very careful studies with systematic increases and decreases in the daily allowance of

milk led to the conclusion that a quart of milk per day must be fed to insure the optimum storage of calcium and phosphorus and the best development of bones and teeth. The third and fourth series of experiments showed the superiorty of milk over vegetables as a source of calcium for growing children.

As pointed out editorially in the Journal of the American Medical Association in the discussion of these results: "The dietary rule of a quart of milk each day for every child is much more than a precept based on individual opinions or drawn by analogy from the results of feeding experiments with lower animals; it now rests on scientific evidence obtained by extensive and intensive experiments directly on the children themselves."

[62809]

WASHINGTON : GOVERNMENT PRINTING OFFICE : 1925

U. S. Department of Agriculture.
Abstract No. 75.

WORLD'S DAIRY CONGRESS, 1923.

ABSTRACT.

MILK AS A STANDARD OF NUTRITION.

By Dr. CLEMENS PIRQUET, Professor and Director, Children's Clinic, University of Vienna, Vienna, Austria.

1. A "nem" is a nutritive, combustible value of 1 gram of average human milk. The name is composed of the initials of "Nahrungs-Einheit-Milch," or "Nutrition Equivalent Milk," and refers to a standard human milk of 1.7 per cent of protein, 3.7 per cent of fat, 6.7 per cent of milk sugar, as well as to a standard cow's milk of 3.3 per cent of protein, 3.7 per cent of fat, 5 per cent of milk sugar.

2. In spite of the great variations of the content of solids in the milk, we are entitled to take a certain theoretical average as a standard, just as we use the horsepower as a standard for our machines, disregarding the fact that every individual horse has a different power.

3. The standard milk chosen has a simple relation to the caloric system, having 667 small available calories in 1 gram, or 667 large calories in 1 kilogram; 2,000 small calories (therefore, 2 large calories) equal 3 nems, or one large calory equals 1.5 nems.

4. This milk unit is used as a metric unit, and is combined with the Latin prefixes for metric fractions, and with the Greek prefixes for multiples of the unit:

A decinem means one-tenth of a nem, or the nutritive value of 1 decigram of milk, 0.1 gm., and is written 1 dn. A centinem is written 1 cn., and represents 0.01 gm.

These smaller units are used only in the calculation of the food intake per square centimeter in its relation to the nutritional surface.

In the practical use of foodstuffs we have to make use of the larger units, namely, the multiples with Greek prefixes: A dekanem (Dn.) means 10 nems; a hektonem (Hn.) means 100 nems. This unit is used in the composition of a recipe for a certain dish, or of the day's program for one person or family. A kilonem (Kn.) means 1,000 nems. We use it in buying foodstuffs for a family, or making recipes for a large number. A tonnenem (Tn.), finally, represents the food value of 1 metric ton of milk: 1,000 Kn., or 1,000,000 nems. We use it in community nutrition.

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5. The food values of all articles used for human food should be determined by substituting a given quantity of the article for milk. Meantime we use a chemical analysis of the food, discount the percentage of combustibles lost in the urine and in the feces, and translate grams and calories into nems.

To shorten the chemical analysis I devised simple methods of examination, based on the testing of dry substances, fat, and ashes, which are easy to apply, and give results that are satisfactory for practical use.

6. The nem values of some of the most important foodstuffs are given in the following table, which gives at the same time the weight of 1 hektonem in grams: If 1 gram of flour has a food value of 5 nems, 20 grams will contain 100 nems, or 1 hektonem. The "hektonem weight" of flour, therefore, is 20.

Nems in 1 gram.		Hektonem weight.
13.5	Pure fat, oil	7.5
12	Butter	8.5
13	Bacon	10
6	Sugar, cocoa	16.7
5	Wheat flour, oat flour, biscuit, rice, ham, fresh fat meat, cheese, syrup, honey	20
4	White bread	25
3.5	Dark bread	30
2.5	Fresh meat, eggs	40
1.25	Potatoes	80
1	Milk, green peas	100
0.67	Fresh fruit	150
0.5	Skimmed milk	200
0.4	Turnips, spinach, cabbage, cauliflower, fresh mushrooms	250
0.2	Lettuce, cucumbers	500

Further details are explained in "An Outline of the Pirquet System of Nutrition," 4 vols., Saunders Co., 1922.

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U. S. Department of Agriculture.
Abstract No. 76.

WORLD'S DAIRY CONGRESS, 1923.

ABSTRACT.

MEANS BY WHICH THE ICE-CREAM INDUSTRY HAS BEEN DEVELOPED IN THE UNITED STATES.

By M. MORTENSEN, Professor of Dairying, Iowa State College, Ames, Iowa.

It is the general belief that ice cream was first made in Italy. It was possibly introduced into France about 1550. The earliest printed record of ice cream in England is found in the Experienced English Housekeeper, published in 1769. The first advertisement of ice cream in the United States appeared in a New York paper, the Post Boy, June 8, 1786. The first wholesale ice-cream business was started by Jacob Fussell in Baltimore in 1851.

The Ice-cream business increased in the United States from 80,000,000 gallons in 1909 to 263,529,000 gallons in 1922. The factors responsible for this remarkable progress may be summarized as follows: 1. The progressive and aggressive attitude of the ice cream manufacturers. 2. The rapid development and improvement of machinery and equipment. 3. Trade papers and books. 4. State agricultural colleges. 5. State agricultural experiment stations.

The ice-cream industry has been developed by men who have employed sound business principles; they have occasionally received help from outside sources. The ice-cream cone, 1904, aided in increasing the sale of ice cream, as did also the Eskimo pie.

The greatest advance in ice-cream machinery was made in 1902–3 with the introduction of the horizontal brine freezer. This was followed by the introduction of the homogenizer and other machinery at present found in an up-to-date ice cream factory.

The ice Cream Trade Journal, the first trade paper in the ice cream field, was started in 1905 and was followed in 1916 by the Ice Cream Review. The first college textbook giving instruction in the manufacture of ice cream was Dairy Technology, by C. Larson and William White, 1913. The first textbook dealing exclusively with the manufacture of ice cream was written by J. H. Frandsen and E. A. Markham, 1915. This was followed in 1919 by The Book of Ice Cream, by W. W. Fisk.

The Pennsylvania State College offered instruction in ice-cream making as early as 1892. At present instruction in ice cream making

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is offered by 30 State Agricultural colleges that give fairly thorough and scientific instruction to from 600 to 700 students annually.

Nineteen state agricultural experiment stations and the Dairy Division in Washington, D. C. carry on experimental or research work on problems related to the ice-cream industry. The first bulletin on the subject of ice-cream making was published by the Vermont Agricultural Experiment Station in 1910. At present 22 experiment station publications are available on the subject.

The problems that have been investigated up to the present time are mainly those related to flavor, texture, and bacteriology. It has been definitely determined that there is a relation between the composition of ice cream and the flavor and texture. Several defects in ice cream have been studied and remedies suggested. The relationship of viscosity to texture has been studied to some extent. Many bacterial analyses of ice cream have been made and methods for reducing the number of bacteria suggested.

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U. S. Department of Agriculture.
Abstract No. 77.

WORLD'S DAIRY CONGRESS, 1923.

ABSTRACT.

THE PREPARATION OF STANDARDIZED MIX IN COUNTRY ICE-CREAM PLANTS.

By WILLIAM WHITE, Dairy Manufacturing Specialist, U. S. Department of Agriculture, Washington, D. C.

There are many country creameries equipped to manufacture any of the standard products such as cream, butter, plain or sweetened bulk condensed milk, skim-milk powder, cheese, and casein. In recent years one other product has been added to this list by a number of plants and that is standardized ice-cream mix. This is sold to large as well as small manufacturers, but mainly to the latter.

Some large manufacturers do not buy their raw material direct from the farmer and find the purchase of a prepared mix an easy solution of their raw-material problem. The small manufacturer finds this same advantage, and in addition is usually able to purchase a better mix than he can make himself. In buying a prepared mix he receives not merely a mixture of cream, milk, and sugar but also the services of the technically trained man who prepared the mix, and of the equipment used in its preparation.

Country plants that are able to make standardized mix without too great an additional expense usually find it profitable. Frequently the only additional equipment needed is a homogenizer or viscolizer. A knowledge of ice-cream manufacture is necessary, and success depends on putting out a uniform and high-grade product.

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WASHINGTON : GOVERNMENT PRINTING OFFICE : 1923

U. S. Department of Agriculture.
Abstract No. 79.

WORLD'S DAIRY CONGRESS, 1923.

ABSTRACT.

SANDY ICE CREAM.

By CHESTER D. DAHLE, Division of Dairy Husbandry, University of Minnesota.

Sandy ice cream is due to the crystallization of some of the lactose in the ice cream. This does not occur unless condensed milk or powdered milk has been used to build up the solid content of the mix. Additional serum solids as furnished from these sources increase the lactose content of the mix.

Lactose, or milk sugar, is not as soluble in water as sucrose, or cane sugar. It has been demonstrated that lactose is soluble to the extent of about 10 per cent at 0° C. At higher temperatures the water is capable of dissolving more lactose, while a lowering of the temperature will cause some of the sugar to crystallize out. This phenomenon occurs in ice cream mixes. An unfrozen mix may show no indication of sandiness, but as soon as it is frozen and held a few days, crystals may begin to form. This is brought about by the temperature changes. While it is possible to have sandiness in the unfrozen mix, there is more danger in the frozen mix.

Lactose crystals may be added directly to the mix in highly concentrated condensed milk. This sandiness will usually be noticed as soon as the mix is frozen unless the mix is pasteurized before freezing. Pasteurization eliminates these crystals but this practice will not prevent the occurrence of sandiness later in the frozen ice cream. This is true if the amount of lactose present is greater than can be held in solution by the water of the mix.

Protective colloids, rennet extract, and other sugars have little, if any, practical value in preventing lactose crystallization if the amount of lactose present is greater than can be held in solution by the water when cooled to hardening room or cabinet temperatures. Gelatine, unless used in prohibitive amounts, offered no relief. Glucose, additional sucrose, and corn sirup are of no practical value.

The degree of concentration of lactose is the greatest factor in the occurrence of sandiness. It was possible to produce sand with an amount of lactose equal to 8.5 per cent when calculated on the basis of the amount of water present in the mix. The total serum solids in the mix which gave this concentration, equalled 10.8 per cent.

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The amount of serum solids in the mix does not denote the concentration of lactose on the basis of the water of the mix. The per cent of other solids, such as sugar and fat, which if high, means that less water is present in the mix, and less will be available for dissolving the lactose; 10.8 per cent serum solids in a low solid mix gave a concentration of 8.5 per cent lactose on basis of water, while the same amount of serum in a high solid mix gave 9.6 per cent lactose on the basis of water. Sand was experienced in this latter mix several weeks before it occurred in the low solid mix. When mentioning the per cent lactose on the basis of the water of the mix, it must be remembered that the water content is not pure water, in fact, it is a sucrose solution.

The temperature at which a mix containing high lactose content is held is a prominent factor in causing sandiness to appear. Temperatures of 15° to 20° F. were very inducive to sand occurrences while temperature of 0° F. was not so inducive—yet it should not be gathered that sandiness can not occur at this temperature. The rate of diffusion is much slower at this low temperature than at 15° to 20° F.

The practice of permitting the ice-cream to become semisoft and later refreezing it hastens the occurrence of sandiness more than any other single factor, provided of course, that the milk sugar is present in amounts which will cause crystallization.

There is but little danger from sandiness if the lactose content is kept below 9 per cent, figured on the basis of water present. As has been pointed out, this amount present may cause sandiness if the temperatures fluctuate greatly and the ice cream is held for a long period of time.

Trouble from sandiness can be easily eliminated by lowering the serum solid content to the point where the trouble abates. The amount of lactose which can be safely used will depend upon the water content of the mix, the temperature of hardening room or cabinets, and the time held in storage.

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U. S. Department of Agriculture.
Abstract No. 80.

WORLD'S DAIRY CONGRESS, 1923.

ABSTRACT.

FACTORS INFLUENCING THE CRYSTALLIZATION OF LACTOSE.

By ALAN LEIGHTON, Physical Chemist, and P. N. PETER, Assistant Chemist, Dairy Division, United States Department of Agriculture, Washington, D. C.

The paper deals with what may be termed pioneering experiments conducted upon aqueous lactose solutions from a number of different angles to obtain a basis for a well-ordered investigation of "sandy" ice cream and the separation of lactose from condensed milks.

The physical-chemical properties of lactose are reviewed, particular attention being given to the solubility curves of the alpha-hydrate and of the equilibrium mixture, alpha-hydrate-beta-anhydride.

Hallimond's[1] work on the more recent theories of crystallization is reviewed. An account is given of laboratory experiments which show that lactose can form highly supersaturated solutions and that a supersaturation curve for lactose in water can be plotted which lies about 30° C. below the saturation curve of the equilibrium mixture. In the area between these curves, the meta-stable area, crystallization can be induced only by the introduction of a sufficient number of suitable nuclei, although it is possible to obtain a slow crystal growth without producing general crystallization. In the area below the supersaturation curve (labile area) a general crystallization will be produced by any nuclei, but without nuclei, crystallization will not necessarily take place.

Hallimond has shown that each foreign substance will exert its own peculiar effect upon the relative positions of the supersolubility and solubility curves. Lactic acid and sucrose apparently throw the curves farther apart in the case of lactose. The milk salts in solution have little or no effect upon the relative position. Certain dyes in rather high concentration throw the curves apart slightly. Any of the solid calcium and magnesium phosphates that might be thrown out of milk in the forewarming process may induce a slow crystallization from the meta-stable area.

These results show that the two principal factors influencing the separation of lactose from a concentrated milk will be temperature

[1] On delayed crystallization in the carbon steels, the formation of pearlite, troostite, and martensite. A. F. Hallimond, Journal of the Iron and Steel Institute, vol. 105, p. 159 (1922).

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and seeding, although we must not neglect the physical conditions in the milk which influence the diffusion of lactose to the crystal surfaces. If a milk is in the labile area, any nuclei will produce a general crystallization; these crystals will be small and, if the milk is well stirred, can probably be kept nearly microscopic in size. If the milk is in the meta-stable area, crystals will not separate out unless certain specific nuclei are present, the crystal growth will be slow and the crystals large.

Lactose is less soluble in sucrose water than in pure water. The solubility in a representative ice cream mix is about the same as that in a corresponding cane sugar solution.

Freezing experiments upon lactose-water solutions covering a wide range of concentration show that it is possible, if nuclei are absent, to carry these solutions well into the labile state with the separation of ice alone. A 9 per cent lactose solution may be frozen solid without the appearance of lactose crystals. We must assume that we are then dealing with a supercooled solution. It has been found possible to freeze a solution containing 30 parts of lactose without separation of lactose until a few minutes after freezing started. In a number of instances the lactose crystals were so fine that they could be made to pass through a filter paper.

Since the usual ice cream mix is of such composition that, upon freezing, ice will separate first, we obtain with lowering temperature a solution which becomes gradually more saturated with the sugars and the milk salts. From the above it can be seen that in the frozen ice cream we may be dealing with a supercooled lactose solution probably in the labile state, or that the crystals may have separated in a finely divided state. It is probable that we nearly always have the former condition. Here again, as has been pointed out for lactose-water solutions, seeding, temperature, and the physical condition in the mix will be the controlling factors of crystal growth.

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U. S. Department of Agriculture.
Abstract No. 81.

WORLD'S DAIRY CONGRESS, 1923.

ABSTRACT.

HOW WE CAN EFFICIENTLY CONTROL OUR MILK SUPPLY.

By C. J. HASTINGS, Medical Officer, Department of Health, Toronto, Canada.

Education, legislation, cooperation, and administration constitute the chief corner stones upon which to construct a permanently efficient milk control.

In our educational campaign we must endeavor to enlighten our people as regards the food value of milk, the dangers of ordinary market milk, the enormous possibilities for contamination, the character of these contaminations, and the best methods of prevention. Nine-tenths of the permanent efficiency of public health administration is obtained by education, and the same is obviously true of our milk control, which necessarily constitutes an essential part of the public health administration of any community.

We can not hope to get efficient legislation without arousing public sentiment to the necessity for it. In the first place we have to demonstrate that milk is the most valuable single article of food we possess, and that modified cow's milk is the most efficient substitute for mother's milk, inasmuch as it is a perfectly balanced diet (this last, of course, depending upon the food of the herd). We must also show that milk constitutes the most efficient food for invalids and that, in fact, every adult should consume at least a pint a day in order to keep up the necessary lime supply and replace other body wastes, and too, that milk is the most economical food we possess. With the addition of bread or cereals it constitutes a perfectly balanced food for the adult, not only supplying heat and energy, but serving also as a tissue builder.

In addition to the fact that milk has been recognized for many years by our most eminent authorities as the most valuable food we possess, more recent developments, within the last decade, have demonstrated the important rôle played by accessory food factors, or vitamines. Inasmuch as all three types of vitamines are present in cow's milk, provided that the herd has been fed upon a properly balanced diet, obviously milk is indispensable in the developing of bone and brawn, the nation's most valuable asset.

Dangers of market milk.—It is a well-recognized fact, which has been abundantly demonstrated, that ordinary market milk is a very

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significant means of the transmission of disease. Milk constitutes the channel through which more disease is transmitted than probably all other foods and drinks combined. Twenty-five and one-half per cent of all cases of tuberculosis in children under 16 years of age is of the bovine type, and transmitted for the most part through the medium of milk, and in addition to this, numbers of outbreaks of diphtheria, scarlet fever, septic sore throat, and typhoid fever have been traced directly to the milk supply; yet this is all preventable, and failure to prevent it in any community means criminal negligence on the part of the authorities.

Sources of contamination and how to prevent them.—Milk supervision must begin with the cow and her environment and end with the consumer. From the cow's udder to the infant's stomach there are from 20 to 25 possibilities for contamination and deterioration of this most valuable food; and for the most important of all these the man handling the milk is responsible. It is surprising what an excellent quality of milk can be obtained from uninviting surroundings, provided the man in charge of the production and care of this milk has an antiseptic conscience and a proper conception of personal hygiene, personal cleanliness, and, furthermore, a proper conception of his obligations to his fellowmen in doing his bit toward preventing the spread of communicable diseases.

With a well-organized milk supervision from the cow to the consumer, we can guarantee a clean milk free from barnyard contamination, but that does not necessarily mean a safe milk. The milk of any community can only be made safe at all times by rendering it bacteriologically clean by scientific pasteurization; that is, by raising the temperature of the milk to 145° F. and holding it at that degree for 30 minutes. This will destroy all disease-producing germs without materially changing the nutritional value, chemical composition, or digestibility of the milk. However, our control should require that all milk be free from barnyard contamination and from any mechanical sediment, as demonstrated by the fermentation test, before we consider it a suitable milk for pasteurization, bearing in mind that pasteurization will not make dirty milk clean. It is intended only to make clean milk bacteriologically harmless.

Pasteurization must be made safe by installing self-registering thermometers in connection with every pasteurization plant. In other words, making the process foolproof.

Objections raised to pasteurization are, for the most part, a pitiful exhibition of ignorance on the part of the objectors. Unfortunately, among the objectors, even at the present time, one occasionally finds a member of the medical profession, and probably one who styles himself a pediatrician. These "fossils" die hard.

[63806]

WASHINGTON : GOVERNMENT PRINTING OFFICE : 1923

U. S. Department of Agriculture.
Abstract No. 82.

WORLD'S DAIRY CONGRESS, 1923.

ABSTRACT.

HEALTH DEPARTMENT ORGANIZATION IN DEVELOPING A MUNICIPAL PASTEURIZED MILK SUPPLY WITH A FINAL BACTERIAL COUNT UNDER 15,000.

By GEORGE H. HART, V. M. D., M. D., Associate Professor of Veterinary Science, College of Agriculture, University of California, Berkeley, Calif.

This paper consists of a discussion of the scope of the work confronting the health department of a large city in developing a high-quality milk supply.

The personnel of the staff, methods of appointment, location of official stations, assignment of territory, and character of the work of the inspectors are discussed.

The development of a proper background of municipal and State legislation to sufficiently empower the health officials to carry on the work is described, also a detailed account of the grades of milk provided for in the California State pure milk law. This law is the enabling act under which cities with an approved inspecting department carry on the grading of the milk supply. It provides for the tuberculin testing, free of charge by the State Bureau of Animal Industry, of cattle from which milk is sold to be consumed in the raw state.

The important factors in getting low-count milk from the producers and how these are placed in general application under practical conditions on the ranches are covered. The sterilizing of utensils holds first place in this regard, and a cheap galvanized-iron sterilizer with wood or oil as fuel for small and medium sized dairies is described.

It is shown how the use of the detailed score card with a minimum standard for dairy inspection may assist in establishing the general use of the hooded milk pail, dry-handed milking, and keeping the cows clean.

Natural conditions render impractical the enforcement of rigid temperature requirements, and milk on the farms must be cooled to only 70° F. A lower temperature standard can not be enforced on account of the water coming out of the ground with a temperature of between 60° and 70° F. Natural ice is unknown and artificial ice not generally available. This handicap is overcome by delivery to the pasteurizing plants twice daily during the warm season.

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The work may be greatly helped by cooperation of the milk dealers in paying a sliding scale of premiums for low-count milk, the highest price to be paid for milk well under the maximum allowed for the grade. Their further cooperation is essential in establishing bacteriological laboratories in the larger plants and the patronizing of commercial laboratories by smaller ones.

The health department must be equipped to collect many wholesale and retail samples, with an organization to enforce degrading, ranch inspection, and reinstatement in a routine manner.

Finally, the installation by the inspecting department of the continuous milk scoring contests terminating at from three to six months' intervals. All of the samples are so-called surprise samples and are taken from the delivery wagons or distributors' ice boxes. This work is done in cooperation with the Dairy Division of the United States Department of Agriculture, who originated it, and the State agricultural college. The tabulated results of this work list the dairies in the various grades in the order of their final score, which is based on all samples collected during the contest period. The results are given wide publicity in the daily newspapers, thus making first place of commercial value and developing keen competition among the distributors.

The work around which the paper is written comprises the actual experiences met with in developing the milk supply of Los Angeles, Calif., to its present status. It has reduced the bacterial count to a minimum, has been a factor in increasing milk consumption, and has met with general cooperation and approval on the part of the producers, distributors, and consumers of milk.

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U. S. Department of Agriculture.
Abstract No. 83.

WORLD'S DAIRY CONGRESS, 1923.

ABSTRACT.

METHODS EMPLOYED WITHIN THE INDUSTRY TO IMPROVE THE QUALITY OF MILK.

By C. D. PEARCE, D. V. M., Chief, Bureau of Dairy Development, The Borden Company, 350 Madison Avenue, New York City.

Efforts should be put forth to utilize all work that has been done to combine the economic problems of the production of milk with the healthfulness, cleanliness, and keeping qualities of the finished product. Score cards are useful in depicting the conditions on the farm, but laboratories are essential to measure the quality of the milk produced. To obtain the greatest efficiency there should be an organization consisting of veterinarians, laboratories, dairy and receiving inspectors—all working together. Any part of this organization is not sufficient by itself, although one man may do the work of both the dairy and receiving inspector. The veterinarians have charge of the inspection work and make a physical examination of the cattle, eliminating such animals as would be a menace to the supply. The laboratory determines the quality of the milk and furnishes the field men with the information as to which dairymen are producing a poor quality of milk. The receiving inspector rejects all milk presented that can not be utilized on account of its being sour or tainted, and is the connecting link between the factory and the field activities. The dairy inspector visits the farms producing the product and through his efforts the equipment and methods are improved.

That portion of our milk sold in New York City and classified as "Grade A Pasteurized" is bought with a premium added for low bacterial content. The counts are determined twice a week by the plate method and a card is sent to each dairyman showing his average count for the week. All dairies showing a high bacterial count are visited by the dairy inspector and corrective measures applied. These methods have improved the quality as evidenced by the increased number of dairymen receiving premiums and the increased demand for the product.

The bulk of the milk bought by us, however, is designated as "Grade B Pasteurized" in the New York City market. Outside this

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market milk is not graded. No bacterial premiums are paid. The Breed or direct microscopic method of determining bacteria is used to indicate the quality. Samples of each dairyman's milk are taken every two weeks. The milk is classified by us as follows:

Milk containing less than 100,000 bacteria per cubic centimeter, Good.
Milk containing 100,000 to 500,000 bacteria per cubic centimeter, Fair.
Milk containing over 500,000 bacteria per cubic centimeter, Poor.

The high-count dairies are considered dangerous on account of their contaminating influence on the good and fair milk when mixed in the storage vats.

The laboratory sends a list to each factory showing the grade of milk produced by each dairyman. The dairy inspector investigates each high count dairy and makes a report on the cause. The next bacterial count taken determines the success of his efforts. At times it is necessary to make a bacterial examination of the milk from each cow in order to locate those giving milk with a high bacterial content.

Our veterinary and inspection forces use a garget cup to locate udder troubles.

The intelligent use of a sediment tester has been of value in eliminating visible dirt.

Since the above plan of dairy control has been in effect there has been an enormous reduction in unsalable products. In comparing 1919 with 1922 we find that we have received in New York City fluid milk market 95 per cent less sour milk, 87 per cent less sour cream, 97 per cent less sour plain condensed, and 73 per cent less bitter cream.

[62358]

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U. S. Department of Agriculture.
Abstract No. 84.

WORLD'S DAIRY CONGRESS, 1923.

ABSTRACT.

QUALITY RATES AND PREMIUMS IN THE FINNISH DAIRY INDUSTRY.

By OTTO P. PEHKONEN, Technical Director, Valio, Cooperative Butter Export Association, Helsingfors, Finland.

The rise and development of quality premiums in the Finnish dairy industry is contemporaneous with the organization of the cooperative creameries since about 1900. The first price fixation was based on the fat content determined by Gerber's acid process and the payment was made for the kilograms of fat in the milk or cream. This first step, on the part of various private interests, resulted in the founding of the central cooperative association of Valio. This introduced the weekly testing of butter and the payment of quality premiums.

The points judged were taste, smell, color, consistency, and packing, and the scale ranged from 1 (poorest) to 15 (best quality). The butter which rated 10.7 points, or more, was considered first-grade export butter and was paid the highest price. The difference in price between first and second grade export butter has risen to as much as 2 marks per kg.

In 1913 the Government Butter Control Institute was founded and all officially controlled butter was sent there for examination. This institute followed essentially the criteria established by Valio.

In 1921 Valio began to pay premiums to the butter makers of its associated dairies. The butter maker received a premium for all butter that by Government tests rated at least 10.7 points (Group I), 10.3 (Group II), and 9.7 (Group III), and did not contain more than 16 per cent water The premium rate for the lowest points of each group was 75 penni per hundredweight, and for Groups I, II, and III scoring 11.3, 11.0, and 10.7, respectively, the premium was 1 mark 25 penni per hundredweight.

Beginning with 1923 the distribution of the units of quality rating was changed to permit the division of the creameries into various groups according to their output and as the basis taken for the new rating was the average of the points attained by each creamery during the previous year under the Government tests. A quality

premium of 1 mark per firkin, with an increase of 25 penni for each additional 0.3 point up to the highest rate of 1 mark 75 penni for the best quality, was the new compensation.

Other cooperative creameries pay their butter makers premiums; a table of ratings commonly followed is incorporated in the text.

Since 1913 Valio and other cooperative creameries have undertaken the manufacture of Emmenthaler cheese and at the present time there are more than 50 factories in Finland. From the beginning Valio has paid premium for quality based on the texture, consistency, taste, oder, surface and appearance of the cheese. According to their tests the cheeses are divided into four classes, the two highest being export cheese. Ordinarily the price difference between the different classes is 15 to 20 per cent. Since the beginning of 1923 the premium for cheese of the first class is 3 marks per cheese (weighing 80 to 100 kg.) and for cheese of the second class, 1.50 marks.

Other cooperative creameries pay their cheese makers a premium generally equivalent to the price of a kilogram of cheese.

The author gives an account of the improvement of dairy products by improvement of the raw materials and the conditions under which they are produced through the efficacy of the various agencies, namely, the establishment of milk-control organizations, State legislation, the institution of practical and theoretical courses of study, and the employment of milk testers to cooperate with the various creameries.

The quality premiums on milk are paid in accordance with the fat content based on the fermentation reductose tests and classification according to the tables of Orla Jensen. The cream is handled in the same manner. Since 1916 Valio has applied itself to the improvement of the quality of consumed milk. Since 1922 the milk has been tested and assigned to four classes, which form the basis of the quality rates.

Briefly, the results of the payment of quality rates are as follows:

(1) In 1913 only 58.7 per cent of the export butter was first class, in 1922 about 80 per cent was first class.

(2) The quality of the cheese has improved from about 35 to 40 per cent export cheese in former years to about 85 per cent export cheese in 1922.

(3) Very satisfactory results have also been obtained with consumers' milk inasmuch as the two lower classes have almost completely disappeared.

The establishment of milk testing, as well as the special premiums and other inducements of Valio, have done much to revive the quality of dairy products.

[62801]

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Abstract No. 86.

WORLD'S DAIRY CONGRESS, 1923.

ABSTRACT.

WHAT CONSTITUTES EFFICIENCY IN PASTEURIZATION?

By S. HENRY AYERS, Research Laboratories, Dairy Division, Bureau of Animal Industry, United States Department of Agriculture.

Since pasteurization of milk for direct consumption is primarily a public health measure, the efficiency of the process must be viewed from this standpoint. The primary object is the destruction of all disease producing organisms with which it may have been become contaminated, but when milk is properly pasteurized it means something more than mere heating and cooling. In addition it means proper handling.

There are really two phases in proper pasteurization, the first deals with the heating of the milk and the second deals with the handling of the milk so as to prevent reinfection with pathogenic organisms. No system can be considered efficient unless both phases are successfully carried out.

Efficiency in pasteurization therefore depends on:

First. Maintenance of suitable pasteurizing temperature and holding period.

Second. Prevention of reinfection by pathogenic organisms during handling after heating.

Temperature and holding period.—For efficient pasteurization it is necessary that all the milk be heated to 145° F. and that all of it be held for 30 minutes at this temperature. Some continuous flow machines do not hold milk this required time.

Too much attention can not be given to this part of the process. Suitable equipment with temperature-recording devices and automatic temperature control is necessary but requires intelligent care and operation. Recording thermometers must be checked daily against a standard thermometer of known accuracy if reliable results are to be expected.

Prevention of reinfection.—This is of equal importance, from the standpoint of efficiency, as proper heating. It is not only necessary to destroy all pathogenic organisms by heating but to handle the milk so that they can not again gain entrance.

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This involves the suitable sterilization of equipment, coolers, bottle fillers, bottle caps, and the handling of the product by healthy employees. No system of pasteurization can be considered efficient unless the milk handlers, including delivery men, are under medical control and are known to be healthy and not disease carriers.

Scientific supervision.—The efficiency of pasteurization depends to a great extent upon scientific supervision of the process. This is a matter of constant, direct observation of each step in the process by a man whose training enables him to interpret every move in terms of the bacteriological results desired. Direct and constant observation of this nature is the greatest guarantee of an efficient process.

Bacteria tests of efficiency.—Reliance must not be placed on such tests alone. They are valuable when properly used and interpreted in connection with direct observations. The greatest benefit from bacteria counts can not be obtained until the present official methods are revised in the light of new knowledge. Quantitative counts alone are not satisfactory. Qualitative results as well must be used. Both these can be obtained on a milk powder agar medium devised in our laboratories.

A special problem.—Pin-point colonies, so called, have caused some alarm in testing efficiency of pasteurization. Recent studies in our laboratories have shown that they are colonies of a nonspore forming thermophilic organism. It is found in raw milk in small numbers and grows rapidly at the pasteurization temperature. This organism, in large numbers, appears to indicate improper sterilization of equipment, and aside from this probably has no significance and is not important.

[62207]

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U. S. Department of Agriculture.
Abstract No. 87.

WORLD'S DAIRY CONGRESS, 1923.

ABSTRACT.

THE SUPERVISION OF THE PASTEURIZATION OF MILK BY STATE AUTHORITIES.

By H. A. WHITTAKER, Minnesota State Board of Health.

This paper emphasizes the importance of the pasteurization of milk as a public-health measure, and as an economic asset in reducing the cost of the sanitary supervision of milk supplies. It outlines the general essentials in the production of a satisfactory pasteurized milk supply from a sanitary point of view, and gives the author's views on the coordination of State supervision and local control of milk supplies. It also discusses the question of the departments of a State government that are best equipped to carry on the sanitary supervision of the pasteurization of milk.

Some of the most important essentials to be considered in initiating a campaign for the improvement of the pasteurized milk supply of a State are mentioned. Many of the suggestions offered for State supervision of milk pasteurization are based on actual experiences of the Minnesota State Board of Health.

62272—23

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U. S. Department of Agriculture.
Abstract No. 88.

WORLD'S DAIRY CONGRESS, 1923.

ABSTRACT.

DEFINITION OF PASTEURIZATION BY LAW.

By Prof. V. VAN DER BURG, Agricultural College, Wageningen, Holland.

The milk-consuming public reposes a certain confidence in pasteurized milk as to its fitness for consumption in the condition in which it is supplied by dairies. Said milk—for the greater part—is consumed as such without any further heating. Therefore, in the interest of public health, it is a matter of necessity that competent authorities should enforce a strict control of the preparation of and the trade in pasteurized milk. The designation "pasteurized" must be restricted to heated milk that has actually been worked in such a manner that the consumer's health will run no risk.

Hence, the selling of pasteurized milk must be practiced by such persons only as have been granted a special license.

An authorization for supplying pasteurized milk is to be granted to such dairies only, as will satisfy certain demands to be stipulated by the government, and the responsible manager of which will have freely submitted to such regulations as will be deemed expedient for efficient pasteurization and control thereof.

The demands which the dairies will be called upon to satisfy will also concern buildings and machinery. The method of pasteurization, as well as the method of handling the milk before and after being pasteurized must be subject to control.

The staff of the dairy will have to be placed under medical control.

Pasteurized m lk must be transported and distributed exclusively in closed vessels.

The temperature of the milk at the time of delivery must not exceed a certain limit, say 8° C.

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U. S. Department of Agriculture.
Abstract No. 89.

WORLD'S DAIRY CONGRESS, 1923.

ABSTRACT.

MILK IN RELATION TO CHILD LIFE AND HEALTH.

By BEN DAVIES, United Dairies, Ltd., London, England.

A study by a London milk distributor of the relationship of milk and infant welfare, and particularly of the relative significance of farm, dairy, and domestic contamination. The writer contends that so far as milk is responsible for infant sickness it is overwhelmingly due to its domestic contamination and that no legislation can be really helpful unless based upon the recognition of this fact.

62370—23

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U. S. Department of Agriculture.
Abstract No. 91.

WORLD'S DAIRY CONGRESS, 1923

ABSTRACT.

THE RELATION OF THE MELITENSIS-ABORTUS GROUP OF ORGANISMS TO HUMAN HEALTH.

By ALICE C. EVANS, Associate Bacteriologist, United States Public Health Service, Hygienic Laboratory, Washington, D. C.

A review is given of the literature relating to Malta fever in man, and in goats and other domestic animals, and to contagious abortion in cattle and swine. Investigations in the United States and in other countries which have led to the conclusion that the causal organisms of these diseases are very closely related, are summarized, and the results of recent investigations by the writer are given in brief.

A serological study of 48 strains of the melitensis-abortus group of organisms from human, bovine, caprine, porcine, and equine sources has been made. These strains were isolated in widely separated parts of the United States and in several European countries. Seven distinct serological types were found, five of which included only one, two, or three strains each. The majority of strains fell into two main types. One type included the majority of bovine strains and the majority of porcine strains. It is designated as the abortus type. The other type included most of the human strains and the one available caprine strain. This is designated as the melitensis type. The types are not restricted to the host species for which they are characteristic, however, for two human strains were of the abortus type and one bovine strain was of the melitensis type. The one equine strain was also of the melitensis type. The simple agglutination test can not distinguish between the abortus and the melitensis types, but they can be differentiated by the agglutinin absorption test.

This and other recent investigations have led to the conclusion that the so-called *Micrococcus melitensis* and *Bacillus abortus* are of the same bacteriological species, the bovine strains apparently having to some extent lost their virulence for man.

Even in subtropical regions where the disease is most prevalent, Malta fever can not be diagnosed without the aid of laboratory tests. Is is commonly an acute disease but often occurs in those regions in a mild ambulatory form. In view of the fact that a closely related type of the Malta fever organism is commonly present in raw cow's

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milk, the possible existence of a mild form of the disease in temperate climates should be investigated. There is at hand suggestive evidence that such a disease does exist. Five hundred samples of serum from patients suffering with all manner of ailments were tested for agglutinins specific to the Malta fever organism. Fifty-seven of the five hundred, or 11.4 per cent, gave a definitely positive reaction. In the majority of cases the reaction was in such low dilutions that the significance is difficult to interpret. In five cases, however, or 1 per cent of the total number, the titer of agglutinins was comparable with the titer of agglutinins in the serum from undoubted cases of Malta fever, in Mediterranean countries and in Arizona, contracted by drinking goat's milk. If these cases of illness occurred in regions where Malta fever was known to be prevalent, they would be diagnosed as Malta fever.

[62395]

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U. S. Department of Agriculture.
Abstract No. 92.

WORLD'S DAIRY CONGRESS, 1923.

ABSTRACT.

CERTIFIED MILK.

By WILSON H. LEE, President Certified Milk Producers' Association of America, New Haven, Conn.

Certified milk is clean, unprocessed milk of uniform composition from healthy cows, and carefully guarded against disease or contamination. Dr. M. J. Rosenau says:

> It represents one of those high ideals which at first seems visionary and unattainable, but is, in reality, an accomplished fact.

In 1891 Dr. Henry Leber Coit, of Newark, N. J., conceived the idea of having a representative commission of physicians establish correct clinical standards of purity for milk, and undertake the control and supervision of the dairy farm producing it. Mr. Stephen Francisco, of Montclair, N. J., who was at that time producing a high-grade milk on his Fairfield Dairy Farm, volunteered to work under the proposed commission. In April, 1893, physicians of Newark, Orange, and Montclair, N. J., incorporated the Medical Milk Commission of Essex County, N. J. Standards, rules, and regulations were formulated, and a contract made with Mr. Francisco. The results attained were most satisfactory, and certified milk became an established fact.

The term "certified milk" originated with Docter Coit, and with the approval of the Medical Milk Commission was registered by Mr. Francisco in the United States Patent Office in 1904, in order to protect it against abuse.

Between 1891 and 1896, 11 other medical milk commissions were formed in different parts of the country, and of course as many different certified milk farms developed. Little progress was made, however, until after the organization of the American Association of Medical Milk Commissions in 1907, and of the Certified Milk Producers Association of America the year following. There was at first more or less friction between the two associations, but when each understood the other's viewpoint, better feeling began to develop. This mutual understanding grew until last year both associations realized that there should be one executive office for the advancement of certified milk, and were most fortunate in being able to persuade Dr. Ralph R. Ferguson to serve as executive secretary of both organizations.

63244—23

In 1912 the American Association of Medical Milk Commissions first published The Methods and Standards for the Production and Distribution of Certified Milk. These have been amended from time to time, and only recently have been entirely rewritten.[1]

Practically all medical milk commissions are appointed by a county or State medical society, although there are a few such commissions that have been created in other ways, notably the one that supervises the Walker-Gordon Farms and Laboratories.

Many States now recognize and protect certified milk by statute; and in at least one State the law requires that the standards approved by the American Association of Medical Milk Commissions and the Certified Milk Producers Association of America shall be complied with in the production of milk before it may be labeled "certified."

No objection has been raised to the use of any of the different dairy breeds for the production of certified milk; but the prime requisite being perfect health and condition, many producers prefer to use good grades, not because the grade is more resistant to disease as many suppose, but simply because it is less expensive to discard a grade cow than a registered pure-bred cow.

Both the number of medical milk commissions and the number of producers have been more than doubled within the past two years. There are now 68 medical milk commissions supervising the work of 176 farms with a daily production of about 80,000 quarts of certified milk, so that the altruistic dream of a few years ago has become an established industry of to-day.

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[1] Copies of the revised Methods and Standards for the Production of Certified Milk may be obtained from R. R. Ferguson, M. D., secretary, 4175 Irving Park Boulevard, Chicago, Ill.

[63244]

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U. S. Department of Agriculture.
Abstract No. 93.

WORLD'S DAIRY CONGRESS, 1923.

ABSTRACT.

THE STATUS OF DAIRY EDUCATION IN ENGLAND AND WALES.

By V. E. WILKINS, B. Sc., Assistant Principal, Intelligence Department, Ministry of Agriculture and Fisheries, Great Britain.

This paper describes generally the scheme of agricultural education (including dairy education) in force in England and Wales. The author points out that the responsibility for providing education rests with the local education authorities in the various counties, and that the functions of the Government department concerned (the Ministry of Agriculture and Fisheries) are limited to aiding and inspecting the work, and insuring that, as far as possible, it is carried out with efficiency and economy. The Government funds available for assisting dairy education have increased very largely during the past decade. Thirty years ago the Government grants in aid of agricultural education were negligible. Today, under a new scheme which was brought into force in 1919, 67 per cent of the total expenditure by local education authorities on agricultural education is refunded by the Ministry. It is not possible to separate from the total expenditure the amount actually spent on dairy education, but this subject receives considerable prominence, and is, at the present time particularly, very much in the public notice. Recently, further funds have been made available under the Corn Production Acts (Repeal) Act, 1921, and considerable attention is being paid to the scheme of dairy education which is in operation.

62288—23

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U. S. Department of Agriculture.
Abstract No. 94.

WORLD'S DAIRY CONGRESS, 1923.

ABSTRACT.

THE EDUCATION OF FARMERS AND DAIRYMEN IN SWITZERLAND.

By Prof. A. PETER, Director of the Dairy School at Rutti-Zollikofen, Switzerland.

In my communication sent in German, I have referred to statistics from secondary institutions in general and after that to the schools of agriculture and dairying.

Switzerland is one of the countries having compulsory primary education and in addition has a relatively high number of secondary schools, colleges, and gymnasia. Seven universities and a polytechnic school afford higher education.

There are four schools of agriculture (theoretical and practical) that train their students in two years and that in 1922 had 223 students enrolled. The winter schools of agriculture complete their programs in two courses of five months each. In 1922 these schools numbered 27 with a total enrollment of 1,780 students. The agricultural population of Switzerland consists of about a million people; in view of that fact the attendance at the agricultural schools might be considered quite satisfactory. The three dairy schools have some 111 students. The higher education of agricultural engineers is undertaken at the national polytechnic school at Zurich; in 1922 the department of agriculture had 141 students. The diploma of agricultural engineer from this institution is given upon the completion of six semesters of work; these graduates make up the faculties of the agricultural schools and the cooperative agricultural classes. Others are active in public affairs, for example, the Swiss Parliament, at the present time, is composed of agricultural graduates.

The government experiment stations and offices of control number five, not including the dairy and bacteriological station which deserves special mention.

From this it may be seen how Switzerland provides for agricultural research and education.

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U. S. Department of Agriculture.
Abstract No. 95.

WORLD'S DAIRY CONGRESS, 1923.

ABSTRACT.

DAIRY INSTRUCTION IN AUSTRIA.

By Dr. W. WINKLER, Agricultural College, Vienna, Austria.

There is a school for dairy science held in conjunction with agricultural bacteriology at the Agricultural High School in Vienna. The lectures (two a week) are compulsory and dairy science is a subject for State examination. The school (Dr. W. Winkler, principal) maintains a laboratory for investigation and research of dairy practice, but does not have a barn or dairy.

At the present time Austria does not have a single school equipped for the technical training of dairy personnel. Nor is there any dairy nspector in any of the Austrian agricultural districts. Vorarlberg, Tyrol and Kärnten each have one dairy instructor.

There is a cheese school connected with the lower agricultural schools in Rotholz near Innsbruch in the Tyrol but this is not in operation at the present time. An earlier cheese school at Doren has survived the war. For practical instruction in the Tyrol there is a herdsmen's school at Imst.

Dairy science instruction, of course, is also undertaken in the agricultural schools especially for girls of the farm and household management classes in Klagenfurt and Kärnten. Necessary instruction in dairy science by means of journeyman's courses is undertaken in some of the farming districts such as Tyrol, Vorarlberg, Kärnten and Oberösterreich.

The Dairy Society of Austria is making an effort to bring into existence a school for instruction and research in dairying that has been provided for by Parliament for three years.

62800—23

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U. S. Department of Agriculture.
Abstract No. 96.

WORLD'S DAIRY CONGRESS, 1923.

ABSTRACT.

THE ARRANGEMENT OF DAIRY INSTRUCTION IN NORWAY.

By Kr. STOREN, Professor in Dairy Technology, Norwegian Agricultural College, Aas, Norway.

The Norwegian dairy schools all belong to the State and the instruction is free.

The lower dairy instruction is built on the grammar-school foundation and is both practical and theoretical.

The practical educationis obtained by doing apprentice work at the private factories, which are partly controlled by the State department of agriculture. The theoretical education is obtained at the dairy schools. For men the apprenticeship is 2 years and the theoretical school course 10 months. The instruction in this consists of lectures and laboratory exercises. For women the apprenticeship is 1 year, the school course is 15 months, and the instruction is both manual and theoretical.

The higher dairy education is connected with the Norwegian Agricultural College, Aas, near Kristiania. It is built on the 10 months' course of the lower dairy schools and a humanistical preparatory instruction answering to *examen artium* (that is, a 2 years' college course in letters and science in America). The studies last 3 years, and the instruction includes lectures, laboratory practice, and design of industrial dairy undertakings.

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WASHINGTON : GOVERNMENT PRINTING OFFICE : 1923

U. S. Department of Agriculture.
Abstract No. 97.

WORLD'S DAIRY CONGRESS, 1923.

ABSTRACT.

INSTRUCTION IN DAIRY SCIENCE IN THE AGRICULTURAL COLLEGE AT WAGENINGEN, THE NETHERLANDS.

By Prof. B. VAN DER BURG, Agricultural College, Wageningen, Holland.

Tuition at the agricultural college at Wageningen has for its object the training and preparation for an independent study of agricultural science and for exercising social professions that require an education in said science.

The higher agricultural tuition in Holland is on a level with university tuition. A diploma of *agricultural "engineer"* is conferred upon such students as have completed their studies in the agricultural college, which normally takes five years. The agricultural engineer, after having made and defended a dissertation, may take his degree as a doctor in agricultural science.

Students have to submit to three successive examinations, (1) the propaedeutical, (2) the "candidate's" (bachelor's), (3) the engineer's examination.

The propaedeutic examination, which takes, in all, 16 months time, is the same for all students in the agricultural college, and comprises the following branches:

a. Mathematics and mechanics.
b. Physics and meteorology.
c. Chemistry.
d. Mineralogy and geology.
e. Botany.
f. Political economy.

The study of a "candidate" takes a period of two years; it is divided into four branches, viz, Plant Industry, Animal Husbandry, Dairy Industry, and Economy. The courses for study are subdivided into *obligatory subjects* and *optional subjects.* In the following list the latter subjects are marked with a +. Students who specialize in dairy science are obliged to submit to examination in the branches indicated by italics.

LIST OF SUBJECTS FOR "CANDIDATE'S" STUDY.

Farm crop production.
Genetics.
Botanical anatomy.
Technics of cultivation.
+Phytopathology and entomology.
+Agrogeology.
Rural engineering.
Microbiology.
Agricultural chemistry.
Stock breeding.
Physiology of animals.
+Calculus of probabilities.
Dairy technology.
Agrarian law.
Agricultural economy and farm management.
Economical geography.
+Electrotechnics.
+Agricultural technology.
+Agricultural architecture.

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As a consequence of the above curriculum of a "candidate's" study, all prospective agricultural engineers will have gone through a general agricultural training before they specialize in a definite branch. After completion of a "candidate's" study the specialization which hitherto had been a very partial one, is carried through more forcibly.

As regards the branch, dairy industry, its study includes at present the following obligatory lecture subjects: (1) Dairy science; (2) microbiology; (3) knowledge of feeding domestic animals; (4) chemistry of facts; (5) one additional optional subject.

For admission to the engineer's examination the candidate has to hand in a certificate of having been actively employed in dairy manufacturing work for at least six months.

The tuition in dairy technology and dairy science may be summarized briefly as: Lactology, composition and properties of milk; chemical and biological testing of milk; manufacturing of butter, cheese and other milk products; chemical analysis of milk products and accessory substances used in dairy industry; milk hygiene; city milk supply.

For the theoretical tuition in dairy industry, one hour a week is available in a bachelor's course and two hours a week in that of an engineer. Three hours a week are apportioned to candidates for practical experimenting in the laboratory for dairy products, whereas, an unlimited number of hours are allowed to those who are reading for their engineer's examination for the purpose of making scientific investigations under the guidance of a professor of dairy science. In addition the students are obliged to be actively employed for some time in the chemical and microbiological laboratories.

In the engineer's course the students are called upon to independently write a paper on one or more special subjects with the aid of literature bearing upon the subject.

It may be remarked that the general library of the college possesses quite a complete collection of manuals on milk and milk products; besides, it subscribes to the chief professional journals and periodicals in different languages, in all about 40 papers. Moreover, the dairy department possesses numerous reprints and reports relative to dairy science and to dairy technology.

The college takes care of about 30 milch cows; the milk is handled in the dairy department. In this department various experiments are carried out, in which the students have an opportunity to participate.

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U. S. Department of Agriculture.
Abstract No. 98.

WORLD'S DAIRY CONGRESS, 1923.

ABSTRACT.

ORGANIZED EFFORTS TO IMPROVE DAIRYING IN CZECHOSLOVAKIA.

By Dr. JAROSLAV KRIZENECKY, In Charge of the Division of Animal Biology, Zootechnical Research Institute, Brünn, Czechoslovakia.

The Republic of Czechoslovakia consists of five territorial units which differ markedly in general economy, culture, and agriculture. Early control in three of these units was similar to the Danish method. Voluntary associations, receiving advice and financial aid from the the boards of agriculture, carried out the control work. Such work grew and prospered until 1914. The war destroyed these organizations, and all the work has to be done again.

Aided by the Ministry of Agriculture, the work of reorganization and extension of dairy control is now in progress in a satisfactory manner. Such control is placed by the Government under the supervision of the animal industry and will be broader and firmer than heretofore.

Uniformity of dairy control throughout Czechoslovakia is to be achieved through the following measures: (1) State provision for the education of testers and inspectors; (2) application of the same principles in all parts of the country; (3) identical forms used for records throughout the Republic.

Dairy control is now being introduced on the basis of these principles. The graduates of the spring courses are now at their posts as testers and inspectors.

The greatest emphasis is laid upon the education of the executive organs of dairy control—the tester and inspector. These are given a six months' course at the agricultural college. Instruction is both theoretical and practical, and includes courses in cattle breeding, feeding, animal hygiene, agronomy, economics, testing, bookkeeping, and the production of milk both from a sanitary and economical standpoint. Supplementary graduate courses will later be given in both practice and science. About 30 testers were graduated this year.

Dairy control will be carried on according to a uniform method throughout the country. There are two grades of control—complete or strict control, and partial or advisory control.

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Advisory control is carried out by private parties, employing their own testers. Private parties may obtain assistance of public research institutes on payment of special fees. Advisory control is intended to improve conditions in districts where the development of the animal industries is mediocre, while strict control has only been introduced in the principal breeding districts where dairying shows a relatively high development.

Each herd is to be tested (for production) every 14 days. If for any reason herds in a given area are tested only every 21 days, a lower classification is given the herds. Such testing at three weeks or longer is usually only found where advisory or partial control has just been established.

Dairy control considers and supervises feeding of dairy cattle. Kellner's principles in estimation feeding values are used. Normal balanced rations with directions for use are those of Prof. J. Just.

The keeping of herd books is included in dairy control. The new books require records of all cows, bulls, and calves, together with information regarding production, age, live weight at birth, description of health, final disposition of the animal, amount of food consumed, physical measurements, photograph of the animal, and data on behavior. There are three kinds of herdbooks: (1) Farm, to be kept by the farmer; (2) communal, to be kept by the inspectors (these are the chief records of breeding and control); (3) district which are intended as summaries showing the progress of cattle breeding in a given district. The last-named shows only animals of excellence and such as found a new line. A special commission passes upon the animals to be entered in the district herdbooks.

Practical work in dairy control has been in progress in Bohemia, Moravia, and Silesia. Such control, owing to the backward condition of the animal industries in Slovakia and Carpathian Russia, has been postponed.

The present organization is only temporary. The National Assembly is preparing a law which will place dairy control in the hands of the chambers of agriculture, which consists of representatives of compulsory farmers' associations. As the work progresses the breeders and producers will assume financial responsibility; the Government funds will be withdrawn from those districts and applied to introducing dairy control in new areas.

[G2301]

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U. S. Department of Agriculture.
Abstract No. 99.

WORLD'S DAIRY CONGRESS, 1923.

ABSTRACT.

DAIRY INSTRUCTION IN SWEDEN.

By Prof. Dr. L. F. ROSENGREN, Principal, Dairy Institute, Alnarp, Sweden.

Dairy instruction in Sweden is organized for the education of—

Persons engaged in scientific teaching and research work.

Consultants and teachers in elementary instruction.

Women home specialists and women teachers whose function it is to work for a rational system of milk-management in the home.

Men and women professionally engaged in the trade, that is, men and women in charge of dairies.

In accordance with these various functions there are required as conditions of participation in this technical instruction a longer or shorter experience in practical dairy work and a more or less thorough grounding in the theoretical side of the work, depending upon the application the student wishes to make of his special training.

All dairy instruction schools are subsidized by the State.

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U. S. Department of Agriculture.
Abstract No. 100.

THE WORLD'S DAIRY CONGRESS, 1923.

ABSTRACT.

THE DAIRYING INDUSTRY OF DENMARK—EDUCATION AS THE TRUE FOUNDATION.

By N. KJAERGAARD JENSEN, Professor of Dairying at the Royal Veterinary and Agricultural High College in Copenhagen.

Dairy education in Denmark is divided into two parts, namely, the junior and the senior divisions. The junior provides factory managers who possess a sound, practical knowledge of the manufacture of dairy produce; the senior is devoted to the training of students who are to become graduates in dairying.

The junior division can again be divided into practical and theoretical instruction. Practical training was for many years free and unrestricted in its application. The defect of this system attracted the attention of The Association of Dairy Managers, and in 1910 a scheme was worked out by the board which embodied a 4-year period of apprenticeship. From 1918 this became compulsory. The rules applied to the teachers are briefly as follows:

Each member of The Association of Danish Managers undertakes to instruct an apprentice in all practical dairy factory work, accountancy and recording. Up-to-date literature is also placed at the disposal of the apprentice.

One year is spent at full routine work, one year in butter making, one year in cheese making, and one year in mechanical training. During the last three years the apprentice must undertake the accountancy and milk-produce records and prove his competency in business transactions.

At the close the apprentice receives a "certificate of apprenticeship" signed by the board of association.

Previous to 1918 every factory had the right to have as many apprentices as it chose, but from that year it was agreed by all the dairy organizations that the number of apprentices should be limited to the proportion of experienced managers, to insure efficiency in manufacture.

Theoretical education.—In 1887 the late Mr. Niels Petersen, founder of the Ladelund Agricultural College, introduced a 5 months' course for dairy managers. In 1892 a 3 months' course was also founded, which was later extended to 4 months. Also, at the Dalum Agri-

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cultural College a special dairy course was commended in 1889, with a program for 3, and later, for 4 months' training.

In 1910, owing to the rapid development of the industry, the dairy associations interfered, and it was agreed by the two colleges to extend the course to 8 months and let the students be examined once a year in the presence of controlling delegates from the Danish Government and the dairy organizations. The students are instructed in chemistry, bacteriology, physics, treatment of domestic animals, machinery, commercial calculations, accountancy, etc.

The advanced education.—Up to the year 1904 all students desiring to become graduates or lecturers in dairying received the same theoretical education as the agricultural students at the Royal Veterinary and Agricultural High College in Copenhagen. The normal course continued about 20 months and two examinations were held.

On September 1, 1904, a supplementary course in dairying was founded. The students attending this course had first to pass the agricultural examinations and show evidence of high character. The period for this course is also 20 months.

The dairy associations were not entirely satisfied with this arrangement, and necessary steps were taken to get it altered by the Danish cooperative dairy associations. The Agricultural High College announced its willingness to support, and new rules were issued to commence from September, 1921.

The new course is spread over two and two-thirds years. For admittance the students must have been at least four years in practical dairy work after the age of 15 has been reached or three years after attainment of the seventeenth year.

The period of education is divided into two parts, each of 16 months. The syllabus of the first course mainly comprises the fundamental sciences.

The first graduate in dairying, educated under the new rules, should complete his studies on the 1st of May, 1924.

Factory chemist-engineers educated at the Copenhagen Polytechnicum also receive a certain dairying education.

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Abstract No. 101.

WORLD'S DAIRY CONGRESS, 1923.

ABSTRACT.

INSTRUCTION IN THE MANUFACTURE OF DAIRY PRODUCTS IN THE NETHERLANDS.

By Dr. K. M. VAN DER ZANDE, Inspector of Agricultural Education, The Hague, Holland.

The Government Dairy School was established by the Government at Bolsward in 1904. Theoretical training, only, is given at this school. For admission, it is required that the candidate has been employed for at least two years in some ordinary dairy business, and during the course the student must spend some time in a dairy.

The purpose of the school is to train dairy managers. The curriculum includes physics, mechanics, mathematics, chemistry, a knowledge of instruments, dairy manufacturing, bacteriology, feeding and sanitation regarding cattle, economics, bookkeeping, instruction in laws, economic geography, Dutch, German, English, and French, and business correspondence in those languages, mechanical drawing, first aid and calisthenics.

The candidate for admission must be at least 19 years old and must provide a certificate for at least two years' employment at a cheese or butter factory. Furthermore, an examination must be passed to show a certain general education. At the end of the second year a final examination is given by the faculty of the school in the presence of the inspector of agricultural education and a commission of three dairy experts. Upon successfully passing this examination, the student is granted a diploma from the school. Of the 230 students who have attended the school during its 19 years' existence, 164 have obtained the final diploma.

The Trade School for Cheese Making at Hoorn offers elementary dairy instruction for the proper trade education of cheese makers. This school is not a Government institution but is endowed by the Government and is under the direction of the inspector of agricultural education. The purpose of the school is to furnish cheese makers for the numerous small dairy concerns in the Province that are engaged almost exclusively in the manufacture of Edammen cheese and whey butter. Because the requirements of the creameries in this district are comparatively limited the training of an expert helper is much simpler than at the Government school.

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Entrance requirements at this school are: Applicant must be at least 17 years old, must show certificate for at least one year's employment as cheese maker in some dairy, must be a grammar-school graduate, and successfully pass an examination as proof thereof. A few visitors are allowed in each course in order to afford dairy farmers and others, who require a thorough insight in the manufacture of cheese, practical instruction. These visitors are not granted the cheese maker's diploma which is given the regular attendants, but they are given a recommendation from the school.

Twenty courses have been given since the founding of the school in 1910. Of the 117 students who have attended, 91 have received diplomas.

Dairy instruction at agricultural schools, etc.—In nearly all the agricultural winter schools some instruction is given in dairying, partly to give the student some knowledge of the principles and practice of dairy manufactures, and partly to instruct future cattle farmers as to the importance of producing good, pure milk for the manufacturing of dairy products and for human consumption.

The influence of organized control on the amount and quality of milk production is also taught along with the importance of breeding and control societies which contribute largely to the improvement of the type and productivity of dairy cattle.

In general, the same courses are given in all winter schools as are given in the secondary agricultural school at Groningen. With the limited time available the instruction is necessarily simple and general in its nature.

In some districts, such as the southern part of Holland, where cheese making is still carried on in the farm dairies, demonstration courses are given wherever possible to the women dairy workers.

Instruction in scientific milking is given in those districts where dairying is an important phase of agricultural activity. Practical instruction is given by an expert milker who has had special training. In addition to this a few lectures are given on the handling of milk, the importance of sanitary measures, and the causes for poor grades of milk.

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U. S. Department of Agriculture.
Abstract No. 102.

WORLD'S DAIRY CONGRESS, 1923.

ABSTRACT.

CHEESE-MAKING INSTRUCTION IN ITALY.

By Prof. GUISEPPE FASCETTI, Istituto Sperimentale di Casefìcio (Experimental Institute of Cheesemaking), Lodi, Italy.

Experiments and instruction concerning the manufacture of cheese in Italy are carried on by graded institutions, which may be classified as follows:

1. Institutes and schools of superior grade.
2. Institutes and schools of intermediate grade.
3. Institutes and schools of elementary grade.

The higher schools and institutes are:

1. Instituto Sperimentale di Caseificio di Lodi.
2. Instituto Sperimentale per il Caseificio for southern Italy, at Naples (in process of organization).
3. The high schools of agriculture (Milan, Perugia, Pisa), where, in addition to chemical and agricultural technology, the science and technique of cheese making are taught.

Intermediate schools and institutes comprise:

1. The Royal School of Animal Husbandry and Cheese-Making at Reggio Emilia.
2. The Dairy School attached to the Royal School of Agriculture at Brescia.
3. The Experimental Institute of Animal Husbandry and of Cheese Manufacture at Cuneo.
4. The Zootechnical Dairy Institute of Rome.
5. The Experimental School for Cheese Making at Boda, Sardinia (being organized).

The elementary institutes and schools impart elementary instruction in cheese making, by rapid, intensive courses of one month's duration, at:

1. The Instituto Zootecnico at Palermo.
2. The Royal Experiment School of Agriculture at Scerni.
3. The Royal Experiment School of Agriculture at Caluso.
4. The Royal Experiment School of Agriculture at Sassari.

There are also short courses in cheese making given in some of the more advanced schools teaching that subject, as at Lodi, where every year two courses of 100 days each are conducted for practical and theoretical instruction in cheese making.

However, the principal task of the advanced schools for cheese making is that of experimental studies leading to the improvement of the cheese industry, since in Italy, where about 50 different types

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of cheese are produced, cheese manufacture is much more important than the production of butter or consumers milk.

The Instituto di Caseificio at Lodi studies exclusively the manufacture of cheese from cow's milk, which predominates in northern Italy, while the Instituto di Caseificio for southern Italy, at Naples, must study the problems concerning goat's milk, or mixed milk.

In the intermediate schools instruction in cheese making is given principally for the purpose of training workers for small and large dairies and cheese factories. The courses last three years at the school at Reggio Emilia and six months at the school at Brescia.

In recent years dairy instruction by means of intensive courses of one month's duration, has been greatly developed. This is done with the object of improving the technical ability of men working in dairies and in large or small cheese factories, as well as of small producers who can not attend regularly the established schools.

These traveling courses follow a didactic program suited to the particular locality in which they are conducted, in order that they may give the most practical results.

They are established, organized, and developed by—

Institutes and schools for cheese making.

Agricultural extension courses.

Organizations of cheese manufacturing firms.

These extension courses, where the cheese-making industry is in greater need of assistance (as in the Provinces of Udine, Bergamo, Sondrio, etc.), are held by experts who lead a campaign in favor of the cheese industry, and by their activities and instruction, bring the aid of science where its need is greatest.

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U. S. Department of Agriculture.
Abstract No. 103.

WORLD'S DAIRY CONGRESS, 1923.

ABSTRACT.

VOCATIONAL INSTRUCTION IN DAIRYING IN SECONDARY SCHOOLS.

By J. R. DICE, Professor of Dairy Husbandry, North Dakota Agricultural College, Fargo, N. Dak.

Vocational instruction in dairy husbandry is now offered in all parts of the United States. That there is a universal demand for this instruction is evidenced by the fact that there is an ever-increasing number of students taking the work each year.

The object of the secondary schools that give vocational instruction is to meet the needs of young men who are unable to take the regular four-year college course but who wish a more extensive training that can be secured in the short courses. In addition to the technical subjects, the course includes work in the supporting sciences and in English.

A large majority of the students taking these vocational courses wish to prepare for dairy farming rather than for dairy manufactures. The entrance requirements for vocational courses are: That the students be from 16 to 18 years of age and that they have completed the work in the common schools or the equivalent. Some schools require the applicant to have spent a year or less on a farm or in a dairy manufacturing plant.

Vocational instruction in dairying is now offered in the United States by:

(1) Schools of agriculture located at the State colleges of agriculture.

(2) Regional or State schools of agriculture.

(3) "Smith-Hughes" high schools, that receive Federal Government aid.

(4) Local or county schools of agriculture.

(5) A limited number of normal schools.

The schools of agriculture located at the colleges of agriculture are offering uniformly good courses, as the college herds and laboratories are at the disposal of the college staff for instructional purposes. The students of these schools enjoy many of the advantages available in a college community.

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The regional or State schools of agriculture have adequate equipment for instruction in dairy production, but few, if any of them, are equipped to give instruction on dairy manufactures, other than for the making of dairy products on the farm.

"Smith-Hughes" high schools are so called because the Smith-Hughes law provides for a Federal subsidy to the school for the teaching of vocational agriculture.

The "Smith-Hughes" high schools, the local county schools of agriculture, and normal schools all offer good courses in vocational agriculture and in the dairy communities and dairy States considerable emphasis is placed on dairy subjects. These schools, as a rule, do not have an elaborate plant, but they give instruction to thousands of students that otherwise would not avail themselves of vocational training.

The length of the vocational course in the majority of the vocational schools is six terms of about 12 weeks each. Some schools give a 2-year course of three terms a year, but the majority of the schools give two terms a year for 3 years. The latter arrangement is preferred as it allows the student to be on the farm during the growing season when he is needed and when he can obtain practical training to the best advantage. In high schools the course usually continues throughout the 4 years.

The course of study includes work in the supporting sciences and in English in addition to the technical agricultural and dairy subjects. Emphasis is placed on such subjects as breeds and judging of cattle, feeds and feeding, care and management of cattle, milk and milk products. The latter includes the testing of milk products, the care and handling of milk and cream together with the principles and practice of making butter, cheese, and ice cream on the farm. A few of the larger schools offer courses in dairy manufactures.

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U. S. Department of Agriculture.
Abstract No. 104.

WORLD'S DAIRY CONGRESS, 1923.

ABSTRACT.

SHORT COURSE INSTRUCTION IN THE MANUFACTURE OF DAIRY PRODUCTS.

By E. H. FARRINGTON, Department of Dairy Husbandry, University of Wisconsin, Madison, Wis.

For the past 30 years the University of Wisconsin has offered a three months course of instruction in the manufacture of dairy products. This work is given during the winter months (November to February), when the 2,807 cheese factories, 667 creameries, and 67 condensaries in the State are receiving their minimum milk supply. The students return to their factories after the three months instruction and about one-third of the creameries and cheese factories in Wisconsin are now operated by men who have taken this short course.

The minimum educational requirements of students entering this short course are six months training in some dairy manufacturing plant. No entrance examinations are given. As a rule the course is attended by young men who have earned the money to pay for their instruction by working in some creamery or cheese factory and they expect to obtain from the instruction information that will help them to improve both the yield and the quality of the product they will make when they return to their jobs.

A good idea of the type of students attending this Wisconsin dairy short course may be obtained from the following list of inquiries we received during the year 1922 for men who have been trained to fill such positions:

Applications received for Wisconsin short-course dairy students in one year.

Butter makers	150	Cheesemakers	170
Ice cream makers	58	College workers	12
City milk plants	8	Milk condensing	4
Manager of dairy business	20	County agents	2
Creamery inspectors	3	Mojonnier testers	4
Cream receiving stations	6	Refrigerator operators	1
Testing dairy products	5	Field man	2
Pasteurizers	5	Diary chemists	3
Churn man	1	Health officers	1

The dairy department is supplied with milk and cream from over 200 farms, and manufactures dairy products during the entire year. All the work of operating the machines, apparatus, and the processes of manufacture is done by the students under the direction of instructors.

The fundamental purpose of the instruction is to teach students not only how to operate the machines and perform the work of the manufacturing process, but to learn the reasons for each step taken in this line of work.

A brief outline of the subjects discussed by the lecturers and laboratory assistants will include the following: Lectures in dairy manufacturing plant management, creamery butter making, factory cheese making, ice cream making, laboratory inspection of milk and other dairy products, the construction and repairing of machinery used in dairy manufacturing plants, elementary bacteriology and dairy chemistry, with a few general lectures on the marketing of dairy products.

In the beginning of the course the class is divided into five sections, and following a general lecture in the morning to the entire class, the laboratory work is divided into five parts, one section working in the creamery, the second in the cheese factory, the third in the ice cream factory, the fourth in the laboratory, and the fifth in the dairy machine shop. A second lecture is given to the entire class after the noon recess, and after the lecture factory work is continued in the afternoon. This routine is continued for one week and the various sections change to another division of the work. Those who have previously worked in the cheese room go to the laboratory, the creamery students to the dairy machine shop, the laboratory men to the cheese room, and the shop men to the creamery. By changing their work once each week during the 12 weeks work, they have an opportunity to take instruction in each department for a period of there weeks during the time they are in attendance.

The State law in Wisconsin requires all the operators of dairy manufacturing plants to obtain a license, which is issued by the Dairy and Food Commission each year. We have recently found by comparing the lists of licenses granted to such operators with our list of names of the former students taking this short course that at the present time there is in Wisconsin one student in about every third factory in the State.

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U. S. Department of Agriculture.
Abstract No. 105.

WORLD'S DAIRY CONGRESS, 1923.

ABSTRACT.

METHODS OF TEACHING DAIRYING TO COLLEGE STUDENTS.

By H. H. DEAN, B. S. A., Professor Dairy Husbandry, Ontario Agricultural College, Guelph, Canada.

This paper is based on the experience of 32 years as a teacher and lecturer on dairying at the Ontario Agricultural College, Guelph, Canada.

The lecturer in order to be successful must know his subject thoroughly, be enthusiastic, have the confidence of students, and be able to inspire his classes with a strong desire to improve their knowledge of the science and practice of dairying.

The chief aids in order to secure this result are, a good textbook, properly equipped laboratories, a good staff of instructors to supplement lectures with laboratory instruction, and sufficient time alotted on the time-table of an agricultural college or dairy school for so important a subject as dairying.

In addition to lectures and laboratory work at the college, dairy students should spend considerable time at commercial plants and dairy exchanges, during or between college terms, as this tends to round out the student's knowledge of dairying. The aim should be to prepare dairymen to meet the actual problems of life when they go out into the world. They should be noted rather as *doers of the word*, not mere theorists who know little about practical dairying. The life of Pasteur, the centenary of whose birth is being observed this year, is a noteworthy example, to those who would achieve greatness in modern science.

Both short and long courses in dairying have been found helpful in training dairy students. For those who have the practical and theoretical training, there is always a demand. The commercial dairy world is ready to pay good salaries to all properly trained young dairymen. In fact, there is danger that in future, teachers of dairying will be scarce. How shall the coming generations be properly taught if there be few good teachers?

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U. S. Department of Agriculture.
Abstract No. 106.

WORLD'S DAIRY CONGRESS, 1923.

ABSTRACT.

COLLEGIATE INSTRUCTION IN DAIRYING.

By W. A. STOCKING, Professor of Dairy Industry, Cornell University, Ithaca, N. Y.

Because of its important relationship to general agriculture dairying has become a highly developed part of the farming activities in nearly all our States, and for this reason the colleges of agriculture have developed teaching and research facilities to meet the needs of this industry.

In the growth of the educational work in dairying two types of organization have developed. In one type the work with the dairy cattle and the problems of production is included in the same department with the work in dairy manufactures. Where this type of organization exists the department is usually known as that of "dairy husbandry." Pennsylvania and Illinois are examples of this type of organization. In the other type of organization the work with dairy cattle and the problems of production is combined with similar work with other breeds of farm animals, in which case the department is known as that of "animal husbandry," while the work with milk and its manufactured products is handled in a department by itself, in which case the term "dairy industry" is usually applied to the department. New York, Ohio, and Wisconsin are examples of this type of organization.

Most departments maintain herds containing representative animals of the leading dairy breeds which are used for teaching work with the students and for experimental purposes. These herds usually include Jerseys, Guernseys, Ayrshires, Holsteins, and, in some States, milking shorthorns.

In some institutions the dairy department maintains a farm for the study of problems of production, both of dairy cattle and their foodstuffs.

In many institutions the teaching work dealing directly with the breeding, management, and feeding of dairy cattle developed first, because these were the problems most important to the farmer. More recently corresponding courses in the handling of market milk and the manufacture of dairy products have been developed. The most recent development in the teaching work includes courses in dairy economics, dairy management, as applied both to dairy farms and dairy plants, and in the marketing of dairy products.

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The particular lines of work given special emphasis depend very largely upon the nature of the industry in the particular State; for example, in Wisconsin special emphasis is given to the problems of the cheese industry, in Iowa, similar emphasis is given to butter, while in New York, special attention is given to the handling and marketing of fluid milk.

In some of the colleges a prescribed course of instruction is laid out for students who are fitting themselves for dairy work. Where this method is followed the student's entire course is definitely prescribed for him. The University of Illinois is an illustration of this method. In other institutions work in dairy industry is optional, leaving the student free to elect little or much as he may desire. This condition exists at Cornell.

In all of the States the aim of the instruction work in dairying is to train persons for practical positions such as dairy farming, breeders of dairy cattle, superintendents or managers of dairy farms, operators in dairy plants, scientific experts in connection with large commercial dairy concerns, or for teachers in the universities and secondary schools and for research workers in the Government departments and State experiment stations.

[62362]

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U. S. Department of Agriculture.
Abstract No. 107.

WORLD'S DAIRY CONGRESS, 1923.

ABSTRACT.

GRADUATE INSTRUCTION IN DAIRY HUSBANDRY

By C. H. ECKLES, Chief, Division of Dairy Husbandry, University of Minnesota, University Farm, St. Paul, Minn.

Graduate instruction, according to American usage, means advanced instruction following the completion of a four year university course. One year of such advanced study, including a suitable thesis, leads to the degree of master of science, or master of arts. The degree of doctor of philosophy represents a minimum of three years of graduate work with the publication of a thesis which makes a contribution to knowledge.

Graduate instruction in dairy husbandry has developed during the past 25 years as a result of the remarkable growth of agricultural colleges and experiment stations and the resulting demand for better trained men to teach dairy husbandry and to pursue research work in this field. A survey by the author shows that at present 121 men are enrolled in graduate work in dairy husbandry in 20 institutions in the United States. Of these, about 20 per cent are candidates for the doctor's degree.

It is generally required that about two-thirds of the time of the graduate student in dairy husbandry be given the major subject and the remainder to a study of a minor which is closely related to the major. Chemistry and bacteriology were found to be in the lead as minors, followed by economics, animal nutrition, genetics, farm management, and veterinary science.

Those interested primarily in dairy products as a rule select bacteriology or chemistry as minors. The demand is growing for men capable of becoming executives in marketing organizations and for filling responsible positions in connection with the marketing service of the United States Department of Agriculture. A group of men are preparing for such opportunities by combining a study of economics and marketing with that of dairy products. This field offers an abundance of excellent opportunities at present.

Those interested primarily in dairy production favor animal nutrition, genetics, or physiological chemistry as minors.

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A reading knowledge of either French or German is required, as a rule, for the master's degree and both for the doctor's degree. Unfortunately most of the graduates in agriculture are deficient in this respect at time of graduation and find it necessary to make up language requirements while pursuing graduate work.

There is less tendency in America than in Europe for undergraduate students to divide their undergraduate course between two institutions. There is a strong sentiment, however, that graduate work should not be taken at the same institution as the undergraduate.

The student planning to pursue a graduate course should recognize that it is more important to select the man under whom to study than to base the decision upon the size or equipment of the institution. The inspiration of a master teacher is never lost.

From one-half to two-thirds of the graduate students are enabled to at least partially finance themselves through fellowships or part-time assistant positions. For a man who takes graduate work immediately following the completion of his undergraduate work it is especially desirable to do so as a part-time assistant.

A considerable number of graduate students in dairy husbandry are preparing themselves for positions requiring a technical dairy expert. Large city milk distributing companies, condenseries, milk powder plants, and other large units engaged in the manufacture of dairy products are feeling the need of high class, technically trained men. The student may get the highly specialized training necessary for this type of work as an undergraduate if he decides early enough in his course to specialize in this line. For the student who, after graduation, needs more training for such work a year of graduate work is especially to be recommended.

Graduate instruction is quite different from undergraduate as given in American universities. Undergraduate study is largely directed by the faculty—graduate study is merely supervised. The graduate student is placed mostly upon his own resources. Many students doing graduate work realize for the first time the nature of the enthusiasm and satisfaction experienced by the explorer in the unbeaten paths of Nature.

The development of graduate instruction is bringing new problems to some universities. The supervision of graduate work is a severe tax upon the time of the advisor. It is also a very expensive type of instruction. The number of students has so increased in recent years and has brought many with mediocre ability that can not fully profit from such opportunities. It is not improbable that in the future some means will be necessary of limiting enrollment to those especially qualified.

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WORLD'S DAIRY CONGRESS, 1923.

ABSTRACT.

PER CAPITA MILK CONSUMPTION FROM THE POINT OF VIEW OF THE PUBLIC HEALTH OFFICER.

By Dr. HAVEN EMERSON, M. D., Department of Public Health Administration, College of Physicians and Surgeons, Columbia University, New York City.

The essential topics to be discussed in this paper may be outlined in the following questions and answers:

(1) What is a desirable daily per capita consumption of milk in a typical American community?

From the point of view of the family economic status and its dietary, probably 1 quart per capita per day is the optimum. From the nutritional point of view not less than 1 pint per capita per day should be used.

(2) Is the consumption of milk a matter of accurate or complete record?

Daily consumption of milk and milk products is rarely if ever made a matter of wholly accurate record. The daily per capita milk consumption in 83 cities of the United States will be quoted and commented upon.

(3) Should health officers attempt to influence milk consumption in their community?

If we admit that the functions of the health officer include investigations of all preventable disorders, diseases and defects, and that there are prevalent nutritional disorders, apparently due, wholly or in part, to failure to use milk in the dietary of persons of all ages, it is obvious then that the health officer should promote, facilitate and encourage, increase in the use of milk, and particularly in those communities and among those groups of any community where the milk consumption is low and nutritional disorders prevail.

(4) What are the reasons for low per capita consumption of milk where this is recorded?

Among the important reasons for low per capita use of milk are (1) ignorance of relative food values by the women of the community; (2) a higher price for milk than the people believe they should pay; (3) fear of pollution, and conveyance of disease through milk; (4) distaste for the pasteurized product; (5) racial customs.

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(5) What have been the causes for increased consumption where this has been observed?

Among the causes for increased use of milk which have figured in different cities are the following: (*a*) The falling price of milk; (*b*) the demand by school children at their home tables; (*c*) confidence in the honesty of official grading and supervising of the milk supply; (*d*) education in dietetics through visiting nurses and other social workers; (*e*) patriotism, as evidenced during the war period.

(6) What should be the public health officer's program now? (*a*) Record the facts of milk consumption not only for the community as a whole but by districts and groups, so far as practicable, and correlate this information with incidence of disease and deaths; (*b*) teach the public the facts, sanitary, economic and nutritional, with regard to the production, distribution, care, and control of milk; (*c*) adopt and enforce sanitary standards for milk and maintain confidence in official grading and supervising of the milk supply by publicity and reasonableness of enforcement; (*d*) encourage cooperation in the production, distribution, and sale of milk to permit of better profits to the producer in the milk trade and lower prices for the consumer.

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U. S. Department of Agriculture.
Abstract No. 109.

WORLD'S DAIRY CONGRESS, 1923.

ABSTRACT.

WELFARE AGENCIES A FACTOR IN EDUCATING CONSUMERS IN THE USE OF MILK.

By LUCY H. GILLETT, of the Association for the Improvement of the Condition of the Poor, New York City, U. S. A.

Welfare agencies and milk organizations might well join hands in advertising campaigns to increase the use of milk.

Milk is talked, urged, and demanded in every health center, welfare office, or clinic where the aim is prevention. The doctor, nurse, nutrition worker, or social worker all have the best interest of the community at heart. They appreciate the value of milk. They have the confidence of the people. Their word carries weight.

Milk is suggested as fitting into the general scheme of a day's diet, in its proper relations to other foods, thus appealing to the family as reasonable and practicable.

Health centers in congested districts reach many people through clinics, classes, home visits, printed material and posters. One dealer reported an increase of 100 per cent in the sale of milk as the result of a poster.

Welfare agencies are very effective educational factors in increasing the use of milk because they are recognized as having no commercial end to gain.

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U. S. Department of Agriculture.
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WORLD'S DAIRY CONGRESS, 1923.

ABSTRACT.

THE WORK OF THE CANADIAN DEPARTMENT OF AGRICULTURE IN INCREASING THE CONSUMPTION OF MILK.

By HELEN G. CAMPBELL, Dairy & Cold Storage Branch, Canadian Department of Agriculture.

Dairying is one of the foremost industries on account of its commercial and economic importance, but chiefly on account of the service which it renders in providing for human consumption foods of the highest nutritive quality. The use of dairy products is conducive to health and every educational activity which stimulates a greater interest in their nutritional value, will advance the cause of child welfare and will be, therefore, most effective advertising, and a contribution toward the solution of public health problems. Helping a child gain or maintain health is the most practical way of furthering public health, and the healthy child is the best advertisement of the dairy industry.

Public health is one of the most important questions in any country and demands the attention of not only the medical profession but of each individual. Because so much of the undernourishment among school children is due to a faulty diet, the dissemination of information regarding the nutritive qualities of dairy products is, to the Dairy Commissioner of Canada, important enough to warrant the creation of a division which has this for its object.

The educational work being conducted by this division emphasizes the service of the dairy industry in promoting better health and brings to the attention of the woman in the home facts, revealed by investigations in the science of nutrition, which are of the utmost importance in making a wise selection of food for her family. It also serves a most useful purpose in stressing the relationship of a suitable diet to physical and moral well-being, and by impressing the fact that every woman in the home is a public health worker if she realizes her responsibility in guarding the health of her family, and if she trains her children in good food habits.

As the success and value of this work depends on its usefulness to other organizations which have at heart the welfare of the child, work is conducted in close cooperation with public health and

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educational bodies. Publications, prepared primarily for the home maker and pointing out the various reasons why milk and milk products should be given prominence in the diet, are widely distributed. Exhibits to visualize the message of the value of milk are arranged at fairs, exhibitions and public meeting, and are of great value in encouraging a more extensive use of dairy products. Local educational effort along these lines in urban centers and rural communities is stimulated and assisted, and various other means are employed to bring salient facts regarding the value of dairy products to the attention of the consuming public. Upon request, cooperation is given to school officials in helping to lay the physical foundation without which educational advantages count for little. Similarly, cooperation is given to local organizations in carrying on a program of education to reach the adults in the community. Milk campaigns are conducted upon invitation, where the milk supply is of good quality and where other local conditions are favorable. The aim of this undertaking is to bring to the attention of children and adults, of school and civic authorities, etc., the value of a satisfactory diet and the advantages from an educational, economical, nutritional, and national standpoint, of a clearer realization of the paramount place of milk in nutrition.

The Dominion Dairy Branch, by its educational work to arouse a greater interest in the quality of dairy products and to stimulate a greater consumption of these foods, adds its quota to the work being done to insure the fine character and strong, sturdy physique of the Canadian child.

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WORLD'S DAIRY CONGRESS, 1923.

ABSTRACT.

COMMUNITY MILK-FOR-HEALTH PROGRAMS AS CONDUCTED BY THE UNITED STATES DEPARTMENT OF AGRICULTURE.

By Miss JESSIE M. HOOVER, Milk Utilization Specialist, Dairy Division, U. S. Department of Agriculture, Washington, D. C.

Educational milk-for-health campaigns, or programs, were introduced by the United States Department of Agriculture in 1918, in cooperation with the State agricultural colleges. The object of these campaigns is to reduce malnutrition through the increased use of milk in the diet. This paper describes their origin and methods in both rural and urban communities; it is illustrated with lantern slides showing an actual campaign in progress.

These campaigns were an outgrowth of the World War. It was not until the war that a comprehensive physical examination was ever given to so large a portion of our population. The large number of young men found physically deficient for military service led to a survey of the school children, and the discovery that about one-fifth of the children were under normal weight. It was also found that this malnutrition was frequently accompanied by a deficiency of milk in the diet. Poverty did not seem to be the cause of this condition, which was common among well-to-do families as well as the poor. It was due to ignorance on the part of parents regarding proper diet and the need of milk, and to the fact that children of school age, not having been taught to use milk, were often disinclined to do so.

Economic reasons connected with the war also led to disuse of milk. The war-time demand for grain and the scarcity of farm labor made milk production costly, and the demand for condensed milk for export took up much of the production. The result was diminished supply and high prices to the whole-milk consumer. The public, being very sensitive to advances in price when the cost of living in general was so high, reduced the family consumption; this reacted by creating a surplus of the milk intended for city supplies, just at the time when prices were necessarily advanced to meet the higher cost of production; and the business of dairying was in great difficulties. Housewives even started boycotts for the avowed purpose of discontinuing the use of milk in their families, except for infants and small children, until such time as pre-war prices should be restored. It became necessary to show housewives that this action would defeat its own purpose, because it would drive producers out of business and reduce the supply of milk until it would not be available at all except for the rich, and general malnutrition would ensue.

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Herbert Hoover, in relating his experiences in feeding millions of people in Europe, said: "Due to the denudation of cattle, milk had been unknown in many places for years. Whole populations were undernourished; but the children were suffering the most acutely from disease and malnutrition." He further said: "The white race can not survive without dairy products."

Up to the time of the war skim milk had been generally fed to animals, and when not so used had been thrown away. Programs for its conservation for human food were put on as a war measure. Out of these grew the present-day programs for a larger use of whole milk. When the war ended the demand for export products ceased, and intensified the existing difficulties. Cows were sold for beef. The Department of Agriculture, fearing the loss of the dairy herds of the country and a general setback to the improvement of dairy cattle, which would react unfavorably on the public health, launched an educational program to disseminate knowledge regarding the importance of milk in the diet.

This work consists of systematic organized campaigns to popularize the use of milk, in successive communities, both urban and rural. The Dairy Division cooperates with the extension services of the agricultural colleges in demonstration campaigns in various States, and State workers then repeat the work county by county where malnutrition exists. It is planned to reach both children and adults. It is a community project, and to get a community well organized requires time, tact, and perseverance. After the condition of the milk supply has been ascertained, as to its sanitary quality, and also its quantity a survey is made of the schools, both city and rural, to ascertain the number of children seriously under weight, and their daily consumption of milk, as well as other health habits.

The schools have cooperated vigorously in this work. They have welcomed trained speakers to give milk talks adapted to children of the various school grades. The children make milk posters, write milk essays, sing milk songs, and act milk plays. Milk feeding demonstrations are conducted; and in many schools a mid-session milk lunch is served, consisting of a half-pint bottle of milk with a straw to drink through and a graham cracker, at a nominal price.

For adults as well as children the value of milk as food is presented through talks, newspapers, radio messages, motion pictures, billboards, electric signs, window exhibits, menu reminders in hotels, and in many other ways.

The work is organized by means of local committees, with a member of the college staff on each committee, to act in an advisory capacity on subject matter. The cost of a milk campaign is small when there is a home demonstration agent, and it is not uncommon to conduct a county-wide program over several months for $150. As an instance of results, in one city where 14 per cent of the school children were below normal weight and only 2 out of 5 were daily milk drinkers, two months after the campaign began only 11½ per cent were below normal weight, and the milk consumption in the city had increased 20 per cent.

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U. S. Department of Agriculture.
Abstract No. 114.

WORLD'S DAIRY CONGRESS, 1923.

ABSTRACT.

COOPERATIVE DAIRYING.

By R. MANOD OWEN, Dairy Organizer for Welch Agricultural Organization Society, Llangerniew, Abergele, Wales, England.

The principles of cooperative dairying.—That membership be limited to milk producers only. That members supply milk for cooperative treatment and sale on their behalf, to be paid for according to results of sale, less costs, and provision for interest on capital and reserve. That weight will be adopted in place of measurement and that the milk be graded and paid for on the basis of quantity plus quality. Flat-rate payment is not equitable, neither is measurement. That all account books be standardized and the accountancy centralized, and that the central office be intrusted with the purchase in bulk of all dairy requisites required by the dairies under its control.

That milk requires treatment at the point nearest to production.—That village cooperative dairies are ideal in hilly countries with bad transport facilities, and are preferable to huge factories at great distances from the point of production. That experience proves that village dairies, dealing with 400 to 600 gallons per day, are a sound "business proposition."

Advantages of cooperation.—Lessening of the work at home on the farm. Broadening of the markets. Uniformity of quality of products. Avoidance of gluts and slumps. Minimizing the losses from "sours."

Advantage to the consumer.—Cleanliness and purity. Hygienic treatment under hygienic conditions. Uniformity of quality.

The national advantages.—Better organization of the industry. Public health safeguarded and supplies steadied.

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U. S. Department of Agriculture.
Abstract No. 115.

WORLD'S DAIRY CONGRESS, 1923.

ABSTRACT.

COOPERATION AS APPLIED TO THE DAIRY INDUSTRY IN ENGLAND.

By the Right Hon. F. D. ACLAND, M. P., Chairman of Governors of the English Agricultural Organization Society, Sprydoncote, Exeter, England.

The most profitable outlet for the dairy farmer in England is the sale of milk in liquid form for human consumption.

Cooperative organization aims at placing milk at the disposal of the consuming public with as little delay as possible after leaving the farm.

The ideal method would be dispatch direct from farm to consuming center, and conversion of surplus milk only at country depot.

Conditions not favorable to this method. Most milk must be treated to keep it in condition for sale in the period which elapses between farm and consumer.

Farmers combine on cooperative lines to establish depots for treating the milk before dispatch and for converting surplus into cheese or other by-product. General method is for a society to undertake the sale of its members' milk, returning actual prices realized less cost of handling. Capital for the erection of depots is found by the farmers.

Any attempts to meet competition of private trade by buying milk outright from members invariably leads to difficulties.

Success of cooperative organization depends on: (1) The general adoption of the cooperative principle in the district; (2) guaranty of supplies; (3) reliable outlets; (4) capable management; and (5) provision for increased capital as the business grows.

Partial cooperation in any district means undue competition and excessive overhead expenses.

A society must be able to depend on supplies to meet its contracts. Definite contracts for supplies are essential.

Outlets comprise: (*a*) Direct sales to consumers in towns near to the producing district, (*b*) direct sale to retailers in more distant markets, and (*c*) sale to wholesalers.

The first two methods are aimed at, the third only being made use of in case of necessity.

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Recent legislation may make it necessary for the cooperative societies to control depots for pasteurizing milk at the consuming centers.

Cooperative societies are inclined to underrate the importance of employing first-class managers at good salaries. Also, they frequently fail to realize the necessity for adequate capitalization.

There are 41 cooperative dairy societies with a membership of 9,228 and a turnover of £2,736,198.

To strengthen the movement a central trading federation of these societies is desirable.

Two important Government committees, the Agricultural Tribunal and the Departmental Committee on Distribution and Prices of Agricultural Produce, have both recently reported in favor of an extension of the cooperative dairy movement. These reports are indorsed by the National Farmers' Union.

[62314]

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U. S. Department of Agriculture.
Abstract No. 116.

WORLD'S DAIRY CONGRESS, 1923.

ABSTRACT.

WORK OF THE NATIONAL FARMERS' UNION IN CONNECTION WITH MILK ORGANIZATION IN ENGLAND.

By E. W. LANGFORD, Ex-President, National Farmers' Union, and Chairman of the Milk and Dairy Products Committee of the Union.

The organization of farming interests in England and Wales is of very recent date, and in 1914 the National Farmers' Union could claim only some 25,000 members, who were far from representing the whole of the country. War control gave an impetus to this organization, and branches now exist in every county south of the Tweed, with some 800 local branches scattered through the counties. Thus the work of the union may be said to be in its infancy. Up to 1917 the union had not taken an active part in organizing the milk industry, but the fixing of prices by the ministry of food made it necessary for some body to undertake to place the producers' case before those responsible for fixing prices, and the union undertook the task. After "decontrol" in January, 1920, the union continued to act as representing the producers, and has been responsible for coming to a satisfactory arrangement with the distributors on a scheme of milk prices, which is fully described in the paper. The organization of the National Milk Publicity Council, representing producers and distributors, is referred to. The paper also describes the work of the union in securing concessions in connection with transport facilities, and in keeping in touch with Government departments concerning legislative measures, etc.

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WORLD'S DAIRY CONGRESS, 1923.

ABSTRACT.

THE COOPERATIVE MILK PLANT IN THE SMALL CITY.

By L. B. COOK, Manager, Dairymen's Association of Beaver, Pennsylvania.

Considerable interest has recently been aroused in the United States in regard to cooperative organizations for farmers, largely as a result of unsettled market conditions for products of the farm. Small dairy organizations have been located in small communities and usually do not have over 50 members and start on a small amount of capital, $10,000 or $15,000. These plants have failed to accomplish as much as they should, due to the fact that members become dissatisfied and break their contracts with the company because the contracts do not seem to be enforceable or else because no one wants to enforce them. The communities are small and thus limit the growth of such plants. Many farmers peddle the milk from house to house in the towns and cause considerable competition. At the beginning these farmer-controlled companies have failed to appreciate the value of a trained manager and consequently have suffered considerable loss. Business methods have not been used in these organizations as they should have been, thus causing losses and curtailing growth. However, these small dairy plants have increased the valuation of their investment and have given the people better and safer milk and dairy products and have also increased local consumption of these articles by carrying a more abundant supply at all times. They have had a controlling interest in standard local prices for milk and dairy products and have had a general uplifting influence on both production and consumption. Therefore these small plants, when considered from all sides, have been a success, although through mistakes in management and poor business methods thousands of dollars have been lost that should have been returned to the members as profits.

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U. S. Department of Agriculture.
Abstract No. 123.

WORLD'S DAIRY CONGRESS, 1923.

ABSTRACT.

MILK COLLECTION, TREATMENT AND DISTRIBUTION IN THE INDUSTRIAL COOPERATIVE MOVEMENT OF ENGLAND.

By A. PARK and R. W. ROYLE, M. Inst. T. English Cooperative Wholesale Society, Ltd.

The paper deals chiefly with the milk department as governed by the society, although reference is made in general terms to a portion of the distributive side of the movement. The principal system of milk collection is by motor lorries working from milk depots within a radius of 5 to 10 miles. The method of treatment of the milk at the depots is described. At present the "flash" process of pasteurization is employed, but probably the "positive" or "holder" process will be in operation before the end of the year. From the depots the milk is transported largely by rail. The disadvantages of this method are referred to in the paper.

Distribution of the milk to societies' members through the various distributive societies is then discussed. The scheme, it is stated, illustrates one of the best features of cooperation, i. e., the elimination of the problem of overlapping. Through the medium of the Cooperative Union of Great Britain, England and Wales is mapped out in areas operated by the various distributive societies. Each one sells its goods in a given area, and each one being a distinct entity, adopts the method peculiarly suitable to the district. Thus the systems of distribution are many and varied, but the scheme has proved undoubtedly successful, and the trade in milk by cooperative societies is gradually increasing.

The authors then illustrate, in detail, three different methods of distribution obtaining with cooperative societies, *No. 1 society* being situated in a town with approximately 130,000 population, and having nearly 40,000 members; *No. 2 society* having a membership of 15,000 and a much larger field of operation, and *No. 3 society* collecting all its supplies from the C. W. S. depot in the country about 8 miles away, and having 19 grocery branches, each of which acts as a distributing center, and the members having to go to their nearest branch for supplies.

In conclusion, the authors express the belief that there is as great a feature in cooperation in the distribution of milk as has been proved to be the case in the distribution of dry goods, etc., involving, as the experiences quoted show, cheaper methods of distribution and a saving to the consumer.

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U. S. Department of Agriculture.
Abstract No. 124.

WORLD'S DAIRY CONGRESS, 1923.

ABSTRACT.

GOVERNMENT CONTROL OF BUTTER AND CHEESE IN DENMARK.

By S. SØRENSEN, Agricultural Advisor to the Danish Government, Washington, D.C.

The present governmental activities in regard to control of butter grew out of a voluntary movement among the farmers to establish a national trade-mark for the purpose of distinguishing Danish butter from other foreign butter on the English market. In the nineties endeavors were made to have legislation passed introducing a national collective trade-mark, but these failed, and in 1900 a voluntary association (Danish Dairies Butter Mark Society) was founded, which adopted the "Lur Brand" as a collective trade-mark for all butter exported by its member creameries. This organization had a great success, and it was only a few years until nearly all the creameries had joined, and adopted the "Lur Brand."

A new movement for legislation was started, and in 1906 a law was passed making the "Lur Brand" compulsory for all Danish butter intended for export. The law also prescribed that butter of foreign origin must be marked "foreign." From that time the "Lur Brand" became a national collective trade-mark, and the Department of Agriculture took over the administration of the law. The "Lur Brand" has to be stamped on two opposite staves of the butter cask, and a printed mark placed on the top of the butter inside the cask.

In 1911 a new law was passed giving the Government power to control not only the trade-mark and the origin of the butter, but also, to a certain degree, the quality. Butter intended for export must be made from pasteurized cream (176° F.). The water content must not exceed 16 per cent. The butter must not be adulterated, and no preservatives other than common salt must be used. It is unlawful to use aniline color.

The control of the quality is carried out as follows: A creamery that wishes to export butter has to secure a license from the Department of Agriculture. If the license is issued the department will furnish the creamery with the necessary "Lur Brand" staves and printed matter, and the creamery must account for all material received. Each creamery is given a special number which is stamped on the staves and printed labels. The Government inspector is thereby able to

always identify butter exported from a particular creamery. The Department of Agriculture has made arrangements with the state experiment station in Copenhagen to control the quality of the butter. It is compulsory for all creameries using the "Lur Brand" to furnish on telegraphic request a cask of a certain day's production for investigation and judging at the experiment station. If the quality is not up to standard a more thorough investigation will be made and the butter maker will be asked to get in touch with the state dairy expert, who will investigate the manufacturing process and give advice in regard to improving the quality. A few weeks later a surprise investigation will again take place, and if the quality is still unsatisfactory the creamery will lose the privilege of using the "Lur Brand." This particular feature of the Government control has greatly improved the average quality of Danish butter.

During the last few years Denmark has had a considerable export of cheese, and in 1922 a law was passed giving the Minister of Agriculture power to fix standards and issue regulations regarding the marking of cheese intended for export. Five standards for hard cheese have been adopted, and three for soft, according to content of fat and water.

All licensed creameries are compelled to stamp their cheese. Immediately after pressing, the hard cheeses are stamped with the number of the creamery, the percentage of fat, and the week in which the cheese is made. For the soft cheeses this information is stamped on the wrapping paper or on the box. During the first year about 700 creameries have been under governmental control.

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Abstract No. 125.

WORLD'S DAIRY CONGRESS, 1923.

ABSTRACT.

BUTTER CONTROL.

By Dr. A. J. SWAVING, Inspector of Dairying, Chief of Dairy Division of the General Direction of Agriculture, Ministry of Home Affairs and of Agriculture, The Hague, Holland.

The Dutch butter control may be considered as an expression of the personal will of the manufacturers of pure butter to give guarantees as to the genuineness and purity of their products and to protect them against substitutes of butter mixed with margarine.

The butter control instituted since 1905, under Government supervision, guarantees that the butter, coming from factories affiliated to the Dutch butter control is a pure product, made from cow's milk, without any addition of foreign fats, and with a water percentage below 16 per cent.

The affiliated members pledge themselves, of their own free will, to observe the rigorous control regulations and the additional rules on the strength of which the Government control marks are distributed.

They are subject to the supervision of the Government dairy inspection service instituted by the Government.

By means of a regular examination of the butter made in the affiliated factories, numerous data have been obtained concerning the composition of the butter in the different seasons in the different parts of the country. These data, viz, concerning the agreement of the Reichert-, Meissl-Wollny number with the refraction number, were collected at the Government dairy station at Leyden.

The evidence of the genuineness of the controlled butter is based on the butter control on the agreement which must exist between the R. M. W. number in the sample of the butter examined, which has left the factory, and the R. M. W. number which was ascertained at the time of the making of that butter in the same factory.

This evidence can at all times be produced by means of the abovementioned Government butter marks and of the registers kept for this purpose at the Government dairy station at Leyden (which distributes the Government butter marks to the butter-control stations), by the control stations (which deliver those marks to the persons affiliated to them), and by the affiliated members themselves, who must

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note down every day the numbers of the marks used by them and of the quantities of butter supplies with these marks.

These Government marks contain, to the left, a capital letter indicating the butter control station that issued the mark paper; to the right, a capital letter is found indicating one of the five sizes of the marks denoting the five different quantities for which the marks may be used, and one or more series of letters and a consecutive number. By means of these indications the origin of the butter and consequently the date of the making, and of the composition of the butter also, can be traced with accuracy.

The Dutch Government butter mark is no mark of quality, but exclusively guarantees the genuineness and the purity of the controlled butter and that the water percentage in the butter is lower than 16 per cent. The butter act prescribed, however, that the butter must contain at least 80 per cent fat exclusively coming from milk.

Also a number of other butter exporting countries, viz, Denmark, Sweden, Finland, Livonia, Esthonia, Ireland, New Zealand, Australia, United States of America, and Canada, by means of the control instituted by them and the legal prescriptions which are in force in them, guarantee their purchasers the genuineness and the purity of the quality of their products.

In accordance with the conclusions of the Third International Dairy Congress held at Scheveningen (Holland) in 1907, it is now proposed:

1. "*That the guarantees given by a Government butter control or by a private butter control under Government supervision be sanctioned by the countries of import and that the relative control marks be officially acknowledged by them.*

2. "*That a direct contact be furthered between the several offices charged with the supervision of the observance of the control regulations, etc., concerning the import and export of butter.*"

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Abstract No. 126.

WORLD'S DAIRY CONGRESS, 1923.

ABSTRACT.

CHEESE CONTROL.

By Dr. A. J. SWAVING, Inspector of Dairying, Chief of Dairy Division of the General Direction of Agriculture, Ministry of Home Affairs and of Agriculture, The Hague, Holland.

The circumstance that, in consequence of taking off fat from cheese milk, cheese was made in the same shape but mutually differing very much in fat percentage, so that skimmed-milk cheese could be sold as fat cheese, led the cheese makers, who were beginning to see the danger of the situation, to devise measures by which the value of their products might be guaranteed and thus protect the fat cheese against dishonest competition of the skimmed-milk product.

In the Netherlands the cheese control was first brought about in consequence of the increased skimming of the cheese milk through the factory butter making in some parts of the country, threatening the existence of whole-milk Gouda cheese and the real Edam cheese (day cheese) as a result of the making of skimmed-milk cheese in Gouda and Edam shape.

Cheese-control stations were established the members of which submitted, of their own free will, to a severe control system and guaranteed a fixed fat percentage in the cheese, and at the same time guaranteed that the cheese was made exclusively from milk without the addition of other fats.

The Dutch Government lent assistance by the disposal of Government marks to those stations, in behalf of their members, and besides, by superintending the observance of the conditions and prescriptions under which the marks in question were distributed.

The cheese marks, made of casein, are perforated and printed in mirror writing with superscriptions indicating the origin of the cheese (name of the control station, name of the maker, etc.). They are put with the printed side on the curd; by pressing and by competent manipulation of the cheese, as well as of the mark, it attaches itself to the cheese rind. The characters and letters placed on the mark, if necessary after cleaning the rind, will always remain distinctly visible.

As in the Netherlands, a few other countries, such as Denmark (1921) and Norway (1922), have instituted an official cheese control.

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(For more complete information about this matter, we may refer to the "Collection of Legislative Measures About Cheese," by Dr. A. J. Swaving, 1923.) Such measures are serious attempts at furthering an honest cheese trade and at preventing fraud.

Seeing that, in this way, the interests of the foreign consumer are not at least furthered, it is desirable that such measures should be supported and that the mutual offices which, in the export and import countries, are charged with the supervision of the prescriptions involved should be in regular contact with each other in order to render mutual assistance and to prevent or to overtake infringements.

This cooperation will be more efficient if the export country should allow no other cheese to be exported but controlled and stamped cheese.

On the strength of all this it is proposed:

1. *That the guarantees given by a Government cheese control or by a private cheese control under Government supervision should be sanctioned by the import countries and that the respective cheese marks should officially be acknowledged by them.*

2. *That the direct contact should be furthered between the several offices charged with the supervision of the observance of the control regulations, etc., on the import and export of cheese.*

[62203]

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U. S. Department of Agriculture.
Abstract No. 127.

WORLD'S DAIRY CONGRESS, 1923.

ABSTRACT.

BUTTER CONTROL IN BELGIUM.

By Prof. C. HUYGE, State Institute of Agronomy, Brussells, Belgium.

Belgium, although never a butter-exporting country, instituted a system of control for domestic butter in 1921. It was found that this measure afforded a good means for combating fraud and at the same time was efficacious in promoting, improving, and perfecting the butter industry.

The principles of organization and operation of the Belgium Butter Control are as follows:

Three organizations work together:

1. The Ministry of Agriculture: The Government lends its support to the institution and has authorized the use of its coat of arms for marks of guaranty. It supports the Control and has put at its disposal the use of the Government dairy station at Gembloux for analyzing butters, free of charge.

2. The National Dairy Society, which organized and supervises the Control, acts as an intermediary between the Government and the National Union of Belgian Dairies.

3. The National Union of Belgian Dairies, consists of a professional union recognized by law; dairies affiliated with the Control.

These three organizations are repressnted by a commission that governs the Control.

The Belgian Butter Control is optional. All petitions for affiliation are subject to very severe examination as the dairies are required to satisfy a long series of distinctly defined conditions for regulation that is designed to prevent falsification as to quality, etc.

The butters coming from the affiliated dairies are given a distinctive mark of which there are various kinds. These guaranty marks are printed on a special kind of thin paper. They are cut and pressed upon the rolls of butter. It is impossible to remove them except by tearing them off in small pieces, and so it is impossible for them to be used twice. Each mark bears an order number which afford the Control an immediate identity both as to the origin of the butter and the date of its manufacture.

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Regulation of the methods used by the creameries is assured by comptrollers and inspectors. The former occupy themselves with the verification of the usage of the marks of guaranty, auditing and inspecting the accounts specially prescribed by the Control, and testing the gauges used in the creameries visited. The inspectors are charged with the preliminary examinations in the creameries petitioning for affiliation, inspecting the creameries under the Control, surveillance and direction of the work of the comptrollers, and visiting creameries that are designated by the dairy station as producing defective butter (or for other reasons). They examine the instruments used in the dairies as well as those used in the depots, commission houses, stores and other places where butter control is necessary.

The dairy station at Gembloux assures the chemical regulation of the butter: water content, index of the volatile fatty acids, index of refraction, etc.

The Control attaches a large importance to the water content of butter, estimating; and quite correctly, that this affords the best criterion for the quality of the work of a dairy. The Control permits a maximum of 16 per cent of water in the butter, and each time that a creamery exceeds this limit the dairy station sends the creamery an announcement to that effect and, at the same time, informs the inspector of that district.

The infringements are penalized according to the regulations.

The income and maintenance of the Control depends upon Government subsidy and a contribution made by each creamery in proportion to the size of its output.

The Control was initiated during a period extremely unfavorable for the development of a work of this kind. In spite of this, slowly but surely, the first part of the program was achieved, that was, to bring under its protection the best dairies in the country and to make their products appreciated at their real value. This, as a nucleus, did much to influence other creameries and moreover, the consumers. This intervention, on the part of the consumers, counted for much in attaining the aims which we summarize as follows:

For the creameries: To improve the quality of the products, to perfect the methods, to assure a regulated trade, to make the butter trade more honest.

For the consumers: Put at their disposal products of the first grade and guaranteed purity, and to enlist their assistance in the suppression of fraudulent practice.

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WORLD'S DAIRY CONGRESS, 1923.

ABSTRACT.

INTERNATIONAL NOMENCLATURE FOR CHEESE BRANDS—MORE UNIFORM STANDARDS FOR FAT CONTROL IN VARIOUS VARIETIES OF CHEESE—UNIFORM METHODS OF EXAMINATION OF CHEESE.

By Dr. A. J. SWAVING, Inspector of Dairying, Chief of Dairy Division of the General Direction of Agriculture, Ministry of Home Affairs and of Agriculture, The Hague, Holland.

Proposals in the name of the national committees of the World's Dairy Association in Denmark, Holland, Norway, Sweden, and Switzerland:

1. The qualifications Emmenthaler, Gouda, Edam, Roquefort, Gervais, Gorgonzola, etc., are regarded as names of kinds of cheese.

Imitations for home consumption, as well as for export, should be stamped distinctly with the names of the foreign countries concerned; for example, Danish Roquefort, Dutch Cheddar, Norwegian Edam cheese, Swedish Gouda cheese, etc.

2. The qualification "whole milk" includes a minimum fat percentage of 45 per cent fat in the dry substance.

Kinds of cheese, made from more or less skimmed milk, should contain at least 10, 20, or 30 per cent fat in the dry substance.

For special kinds of cheese minimum fat standards are allowed, for example:

For Gouda cheese: "Whole milk" with a minimum fat of 45 per cent in the dry substance; 30 and 20 per cent in the dry substance.

For Edam cheese: 40, 30, and 20 per cent in the dry substance.

For Roquefort cheese: 50 per cent in the dry substance.

3. Unification of the prescriptions for the taking of samples and for the chemical examination of cheese (moisture and fat) in case of objection when exported.

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U. S. Department of Agriculture.
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WORLD'S DAIRY CONGRESS, 1923.

ABSTRACT.

IN BEHALF OF AN INTERNATIONAL CONTROL FOR THE CHEESE TRADE.

By Prof. GUISEPPE FASCETTI, Lodi, Italy, in Behalf of the Executive Committee of the Italian Section of the International Dairy Federation.

The Italian section of the International Dairy Federation has carefully examined the suggestions submitted by the Swiss Milk Commission concerning the important question of an international control for the cheese trade. The suggestions are:

1. Specification of a minimum of fat in different kinds of cheese and of a nomenclature corresponding to the fat content.

2. Specification of a minimum of dry matter and, respectively, of a maximum quantity of water for the different kinds of cheese.

3. Declaration of the origin of the cheese.

The Italian section of the International Dairy Federation does not think that it would be possible to generalize the criterion, though theoretically correct, of the designation of a minimum of butter fat in the great majority of the different kinds of cheese.

The section holds that this should be limited to the small groups of cheeses in greater demand in international trade which are generally made of unskimmed or whole milk.

It would be difficult to apply this criterion in the case of cheeses made with milk of one or two milkings, more or less skimmed, according to the time which it is allowed to stand, and different in the various seasons. In the case of these cheeses, technical factors have greater influence than the composition of the milk. These may lead to wide variations in the proportion of fat to the dry matter of the cheese.

In such cases it seems more just to designate in words, rather than by a number, the probable quantity of fat contained in the cheese under consideration, provided the cheese is technically made in the usual manner.

This could be designated as follows: Cheese from milk one-fourth skimmed, or three-fourths cream; cheese of milk half skimmed, or cheese half cream, and so on.

As to compulsory declaration of a maximum of water contained in the cheese, the quantity of water varies but little. It is fre-

quently found that, due to commercial exigencies, cheeses are shipped at different stages of ripening. Thus it is not an easy matter to guarantee the maximum quantity of water, unless an accurate analysis were made each time of a large number of cheeses.

Under present conditions, knowledge of the quantity of water in cheese is required more for supplying useful information to commerce than for legal purposes.

Regarding compulsory declaration of the origin of the cheese, the Italian section feels that every type of cheese should be distinguished and marked with its origin. This would be superfluous only in the case of cheese coming from the country where that type was originally made.

On the basis of the above considerations, the Italian section of the International Dairy Federation has the honor to submit the following suggestions:

The congress, recognizing the utility of placing the cheese trade under an efficient international control, suggests that in each country or State—

1. A minimum of fat be established in the percentage of dry matter of export cheeses made from whole milk.

2. In the case of cheese made from milk that is partially skimmed, they should be so designated, giving the fractions of the skimming of the milk (cheese of half skimmed milk or one-third skimmed or one-fourth skimmed, etc.).

3. That studies be encouraged for ascertaining the quantity of water contained in each type of cheese, and at the different stages of ripening, to supply commerce with useful information.

4. Finally, that the congress will consider:

That the exact origin of the cheese be ascertained, adding to the name of the type of cheese the name of the country in which it was made.

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ABSTRACT.

THE COORDINATION OF FEDERAL, STATE, AND MUNICIPAL CONTROL.

By W. S. FRISBIE, Chemist in Charge of Cooperation, Bureau of Chemistry, U. S. Department of Agriculture, Washington, D. C.

This paper deals with the question of coordination of the laws, rules, and regulations and administrative procedure so far as milk and milk products are concerned. A résumé is given of the requirements for the production, sale, and distribution of milk in the larger cities of the United States. Comparisons are made with requirements in the States in which these cities are located and evidences presented of the lack of coordination not to the best interests of the dairy industry. Suggestions are made for methods of procedure to eliminate, so far as possible, unfavorable conditions existing at the present time.

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U. S. Department of Agriculture.
Abstract No. 132.

WORLD'S DAIRY CONGRESS, 1923.

ABSTRACT.

CREAMERY AND TESTERS LICENSE LAWS.

By H. W. GREGORY, Chief, Department of Dairy Husbandry, Purdue University, La Fayette, Ind.

The object of a creamery and testers license law is to insure the farmers and dairymen who sell milk and cream on the butter-fat basis that the test of such milk and cream will be made correctly and by recognized standard methods. Such a law also insures manufacturers of dairy products, who buy milk and cream on the butter-fat basis, that their agent or tester will correctly weigh and test the milk and cream bought.

To accomplish the purpose of the creamery and testers license law, most States require that all cream-shipping stations, milk plants, and condensaries buying and paying for milk and cream on the butter-fat basis have in their employ a licensed tester who is responsible for the operation of the Babcock test.

Thirty-four States of the United States have a law on their books which may be considered a creamery and testers license law. While the object is practically the same in each State having such a law, these laws differ a great deal in the method of administration and in the requirements as to the methods of testing, etc. Only two States have an examining board before which all cases are brought for recommending the revoking of the creamery or testers license. In all other States the licenses are revoked by the commissioner of agriculture or the director of the State experiment station without such recommendation.

It was found that there was very little uniformity among the creamery and testers license laws of the different States as to the requirements of a creamery license. Thirteen of the States studied did not require a creamery license as far as the testing of milk and cream was concerned. The charge for such a license in 14 States requiring a license varied from nothing to $10 a year. In three States the cost of a creamery license depended upon the amount of products handled. All States having a creamery and testers license law required the tester to hold a license. The testers in practically all the States secure their license by passing an examination. This

examination varies a great deal in the different States, some States giving a much more thorough examination than others.

The requirement of the glassware used in connection with the Babcock test varied considerably in the different States. Eight States specified that 8 per cent milk test bottles must be used. Four States sepcified that 10 per cent milk test bottles must be used. Eight of the States permitted the use of 9 gr. and 18 gr. cream test bottles, while five States only permitted the use of 9 gr. cream test bottles. Fifteen out of the 27 States having a creamery and testers license law retest all glassware within the State.

The creamery and testers license law in Indiana has been in operation since 1913 and is considered one of the best of its kind. The Indiana law requires that all plants and stations buying cream and milk on the butter-fat basis and all testers hold a license. All glassware used in connection with the Babcock test must be retested, and the 8 per cent milk test bottle and the 9 gram cream test bottle are specified as Indiana standards. Milk and cream tests must be read at a temperature of 135°–140° F. The test must be subject to this temperature for 10 minutes and 5 minutes for cream. All cases for the revoking of licenses are brought before an examining board, composed of seven members, who make recommendations to the State agricultural experiment station for revoking the license.

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ABSTRACT.

THE ACETIC INDEX IN THE ANALYSIS OF BUTTER.

By Dr. ELIA SAVINI, Istituto Sperimentale di Caseficio (Experimental Institute of Cheesemaking), Lodi, Italy.

The adulterations of butter with foreign fats, which are constantly being made, consist of the addition of coconut and margarine fats, additions formerly made separately, but which it is now endeavored to combine.

Fats are all easily and completely soluble in ether, in chloroform, in carbon tetra chloride, in carbon disulphide, in turpentine, in paraffin oil, in benzol, and in petroleum ether. These solvents, therefore, can not furnish a method of identification. However, the effects of alcohol and of acetic acid on fats are very different. It is, in fact, upon these reactions that two methods for the analysis of fats are based: The Crismer index, or temperature of solution, its solvent being alcohol of known density; and the Valenta index, which uses glacial acetic acid. The determination of the acetic index is based on these methods, It has been suggested by Professor Fascetti and extensively used by me in the analyses of butter, to find the presence of foreign fats added to it.

In order to måke possible and practical the method of determination by acetic indication, it is necessary not only to work with an acetic acid of a definite density and concentration, but also to determine from the sample of fat the content of free fatty acids.

The determination of the acetic index is then obtained in the following manner: In an ordinary test tube, of strong glass and well dried, 1 cubic centimeter of fat under examination is introduced by means of a pipette. The fat is previously melted and filtered. Then, without touching the sides of the test tube, 4 cubic centimeters of acetic acid of a definite concentration are introduced by another pipette. The test tube is closed by means of a cork having a hole in it. Through the hole a thermometer graduated to one-fifth or one-half of a degree is placed. The test tube in turn may be introduced into a larger one about two-thirds filled with water, and fastened in it by means of a rubber or cork ring. The whole is placed in a water bath, and heat is applied. The tube should be shaken gently from time to time. The fat and acid solution, very turbid at first, becomes

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less so as the temperature rises, and finally becomes clear sharply. The device is then removed from the bath, shaken slowly to cool it a little, and observation is made at what temperature the solution begins to become turbid again. Simultaneously with the determination of the acetic index, one should determine the free fatty acids, or the acidity.

Indicating by N the value of the acidity, and by T the temperature of solution of the fat, the corrected acetic index will be T plus N.

The determination of the acetic index is a valuable aid in judging whether butter is pure or not, even after the usual tests have been made, bearing in mind that in the case of fresh and pure butter it varies from 64 to 66, with an average of 65.

An acetic index below 63 is a sign of adulteration with coconut fat; and this amounts to about 5 per cent when the index varies between 60 and 61.

In order that the acetic index may give valuable results, it is necessary to carry out the test in the manner I have indicated and determine the acidity of the butter, especially if the latter is not fresh. This value will be summed up with that of the acetic index as a basis of judgment on the corrected acetic index.

The determination being an easy and rapid one to execute, it may serve to establish a fairly accurate estimate with rapidity; while determinations by means of the Titolo Wollny and Titolo Polenske tests require a longer period of time.

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WORLD'S DAIRY CONGRESS, 1923.

ABSTRACT.

EFFECT OF TOPOGRAPHICAL CONSIDERATIONS ON THE PROBLEMS OF MILK DISTRIBUTION.

By R. STENHOUSE WILLIAMS and A. T. R. MATTICK, National Institute for Research in Dairying, University College, Reading, England.

This paper is concerned with the necessity for considering the problems of the distribution of milk under the conditions which exist in each country. It points out that the problem is affected by the nature of the milk itself, by the time of haulage, by the variations in temperature in different countries, and by the conditions in the consumer's house. Since these conditions differ very much in different countries, it is clear that a solution of the problem which is applicable to one country is not, necessarily, equally applicable to another.

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U. S. Department of Agriculture.
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WORLD'S DAIRY CONGRESS, 1923.

ABSTRACT.

MILK TRANSPORT IN ENGLAND.

By J. S. LATHAM, Director, United Dairies, Limited, 34, Palace Court, London, W. 2.

The development of transportation is vital to a nation. Since 1918 road transport in Great Britain has made rapid progress. In no business does transport play a greater part than in the milk trade. By more rapid handling and the prevention of overlapping, considerable economies have been effected both by farmers and distributors. United Dairies Limited, the largest milk firm in Great Britain, has made a scientific study of transport.

The railway companies provide special accommodation for loading at country stations, and in most cases, special milk trains. At the principal London termini these are run into separate platforms, the same height as the floors of the motor and horse wagons.

The road transport of United Dairies Limited includes: (1) The carrying of milk from farm to country depot. This collection is made by some two hundred 3-ton and 30-cwt. motor lorries over an area of 30,000 square miles on seven days a week. The lorries travel 2,000,000 miles a year. Each morning the lorries go out loaded with empty churns and return later to the 60 receiving depots with full churns. (2) The carrying of milk from railway termini in London to pasteurization plants and town distributing centers. Over 100 petrol electric vehicles as well as horse-drawn wagons are used. There is little difference in the cost per gallon for handling between petrol, electric, and horse drawn vehicles. (3) Wholesale and retail delivery by road. The wholesale service of milk involved the carrying, chiefly by heavy type lorries, from the pasteurizing plants to the proprietary dairymen. There is also retail distribution from the retail distributing depots to consumers. In London there are about 3,000 separate routes, all of which, with the exception of those using 600 pony and horse carts, are made with push trucks.

This extensive transport system is administered by three directors. The country depots are divided into two areas, each under the control of a director, who with the London director, are able by a system of monthly returns to control the operations of each vehicle. Under the chairman of the committee works the transport manager. He is

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responsible for three departments—(*a*) inspection and maintenance of vehicles; (*b*) secretarial; (*c*) statistical.

Each vehicle is inspected regularly by skilled engineers. Repairs are crrried out at depots which can deal with 25 vehicles. A mechanic in each area is responsible for the economical working of transport, prevention of overlapping, reduction of idle running, and checking petrol consumption. He visits each depot at intervals of 10 days to carry out necessary repairs and to overhaul in turn each vehicle. In London there is one large central depot for all repair and maintenance work. The cost of each country vehicle, including running repairs and tires, is about £10 per 1,000 miles.

In order that exact costs may be ascertained, an elaborate system of returns is in force. A valuable index of costs is the gallons collected per mile run. During February the country vehicles traveled 140,000 miles and collected 12,900,000 pounds of milk, at an average cost of 0.9 pence per 10 pounds. In London 80,000 miles were traveled, and over 30,000,000 pounds of milk carted by motor and electric vehicles at a cost of under 0.3 pence per 10 pounds.

In addition there are subsidiary transport activities. The inspectors of dairy farms travel on motor cycles, which are provided with side cars fitted with boxes for carrying samples of milk taken. The average cost of 4½-horsepower machines is 2.5 pence per mile. The supervisors of the areas are transported in cars chiefly of the 10-horsepower two-seater type. United Dairies Limited are always looking for new methods of transportation in order to accelerate the speed of handling their perishable products.

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U. S. Department of Agriculture.
Abstract No. 137.

WORLD'S DAIRY CONGRESS, 1923.

ABSTRACT.

TRANSPORTATION OF MILK IN BULK.

By JOHN P. DUGAN, General Baggage and Milk Agent, Baltimore & Ohio Railroad Co., Baltimore, Md.

The railroad is vitally interested in the success of the milk industry and particularly, of course, in the efficient transportation of milk, which has not, in its development, kept pace with the development of other phases of the industry. The tank cars and the consolidated supply system are innovations offering decided improvements in milk transportation.

The modern city, outgrowing self-contained and near-by milk production supply, thought about the necessity of rail transportation of milk, beginning, probably, in 1838, and being first successfully demonstrated in 1841. It started with the can method of shipment, and that method has continued until the enormous number of cans in use has loaded the industry with heavy expense. My knowledge of this and other facts made me enthusiastic over the tank-car method, revolutionary though it was, when introduced by the Harmony Creamery Co. Like Sunday shipments of milk, the tank car method has had opposition but eventually those who are pioneers in introducing improved methods will be honored.

Milk is the ideal food and its importance to humanity can not be over-estimated. The industry is regulated almost as much as are the railroads, and the spread between cost and selling price is small. Hence every consideration points to the necessity of improving the quality of milk and the efficiency and economy of the milk business. And the tank car has already proved its value in the following 12 ways:

1. A more uniform or regulated temperature.
2. Improved bacterial and acidity tests.
3. Improved efficiency at shipping and city plants account of reduction in force.
4. Elimination of sour milk losses, etc.
5. Reduction in labor at both shipping and city plants.
6. Discontinuance of refrigeration or icing cars.
7. Elimination in shrinkage or spillage loss.
8. Elimination of shipping cans.
9. Elimination of can washing and similar expense.
10. Elimination of cost of can repairs, replacement, etc.
11. Reduction in drayage or hauling expense at shipping and city plants.
12. Preventing congestion at shipping and city plants.

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Better quality milk demands better sanitation and less exposure to contaminating elements, and these requirements are best satisfied in the tank car.

The tank car is only practicable with the consolidated supply system and depends on it. This, in itself, has demonstrated its economy and efficiency and I recommend it unreservedly to progressive dairymen, even aside from the advantages it brings to the tank-car method.

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U. S. Department of Agriculture.
Abstract No. 138.

WORLD'S DAIRY CONGRESS, 1923.

ABSTRACT.

BULK TRANSPORTATION OF MILK BY RAIL.

By H. E. BLACK, Superintendent of Milk Service Department, New York Central Railroad Co., New York City.

A new era in milk transportation by railway is at hand through the developnmet of the glass-lined tank for bulk transportation of this product.

The first development of this nature employed two large glass-lined steel tanks of 2,500 gallons capacity, permanently fixed, one in each end of a refrigerator car. Milk which had been pre-cooled was pumped into the tanks at the country plant and removed at the railway terminal to tank trucks for transportation to the city plant. Economies totaling in excess of $35,000 resulted to one company of Pittsburgh, Pa., in one year through the operation of two cars so equipped.

However, this project did not adapt itself to the New York market with the strict regulation maintained by the health authorities of this product, and it remained for Mr. A. H. Smith, president, the New York Central Lines, in conjunction with Mr. E. G. Miner, of the Pfaudler Co., to devise what appears, from tests thus far conducted, to be the solution of all foreseen difficulties, and one that will open up unprecedented distances for milk and cream transportation, namely, the container-car adaptation for the transportation of milk. This project contemplates the handling of milk, cream, and condensed milk in a portable container consisting of a glass-lined steel tank, which in the case of containers now built has a capacity of 825 gallons, incased in an insulating container of extremely rigid construction. The tank is fitted with a manhole to admit a man in cleaning, also sanitary filling and discharging fixtures; access to which is gained through hinged traps in the container, which are equipped with locks. The container system provides that the portable container shall be filled and locked at the milk-shipping station and lifted aboard the container car by a simple hoisting device attached to the four eyelets, one on each top corner. The car which permits the loading of multiples of these containers is very similar in appearance to the low side gondola car, the steel sides of which absolutely prevent removal of contents of the tank through the outlet valve when the container is

in position. At destination the container is lifted from the car to consignee's truck by crane for transportation to the distributing plant, where it is emptied by attaching sanitary pump and piping.

The container system for the transportation of milk has many advantages over methods previously devised for this service, the following being the most marked over the transportation in 40-quart cans:

1. Elimination of the costly can, with high depreciation and expensive handling charges.
2. Elimination of necessity of refrigeration cost while holding milk or in transit.
3. Increased efficiency and reduction of plant overhead, account of simplicity of operation.
4. Elimination of overtime expense due to time-saving features.
5. Elimination of sour-milk losses.
6. Elimination of losses due to spilled milk and adhesion to cans.
7. Improved product due to—
   (*a*) Maintenance of practically constant temperature.
   (*b*) Use of sterile container.
   (*c*) Elimination of 10 of the 17 operations in the handling in cans with contingent possibilities of contamination.

While the undesirable features of can handling have long been appreciated, it is the advantages of the container system over other forms of bulk transportation which give it marked distinction.

1. The container tank is devised to carry in bulk, singly or in multiples, an amount of milk best adapted to the majority of milk stations.
2. No centralization of supply with objectionable features is necessary.
3. Elimination of the most objectionable transfer of milk from tank to tank truck in railway yard and possibility of contamination.
4. Specialized trucking equipment unnecessary.
5. Standard platform trucks for handling containers may be utilized in other service.

With this system, which is now passing through the experimental stage, the future of an adequate and unexcelled supply of this product, so vital to national health, seems assured, and it is our earnest belief that within the next two years great changes will be seen in the transportation and distribution of milk due largely to this development.

[62803]

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U. S. Department of Agriculture.
Abstract No. 140.

WORLD'S DAIRY CONGRESS, 1923.

ABSTRACT.

THE COSTS OF MILK DELIVERY.

By ASA B. GARDINER, President, Western Maryland Dairy, Baltimore, Md.

The expenses of the milk dealer incident to the delivery of milk are but little known to the consumer, who has no concern in those details, however vital their importance may be to the dealer himself.

Uneconomical management is disappearing from the milk business. and in the larger cities of the United States and Canada it is now evident that only those organizations that have a large volume of trade, and practice efficiency and economy, continue to exist. In those cities the small dealers, after unprofitable years, are succumbing to the present narrow margin of profit on investment.

Due to the trend of business toward small profits it is expedient for the dealer to study the unit costs of production and handling per quart. In the course of a month or year, a slight fractional saving per quart, when multiplied by thousands or millions, becomes an estimable sum.

Few dealers use bookkeeping that will show them the unit costs for the many individual operations incident to selling milk.

The dealer has four major costs and all expenses should be chargeable to one of these four:

1. The cost of the raw milk and its delivery to the plant.
2. Production costs. Under this heading come labor and supervision, inspection pasteurization, bottling and capping, refrigeration, heat, supplies, repairs, bottles and their cleansing, delivery, etc.
3. Selling expense.
4. Administration or overhead expense. These costs include taxes, insurance and depreciation, salaries of executives and bookkeepers, legal service, and many miscellaneous items, such as telephone, telegraph, stationery, etc., not chargeable to the other groups.

The proportionate division of costs, after subtracting the first cost of the raw milk, is approximately:

Selling costs equal 55 per cent of total costs.
Production costs equal 30 per cent of total costs.
Overhead costs equal 15 per cent of total costs.

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A more detailed division, where milk was 13 cents per quart, was:

	Cents.
Farmer	7½
Dairy employees	2½
Merchants supplying bottles, fuel, feed, etc., taxes, insurance, and depreciation	2½
	12½
Investors received	½
Total	13

Delivery costs are greatest and therefore of major importance. The first consideration should be the volume of the delivery wagon. A study made some years ago is still an index to successful management. The following results show the quarts per route per day and the margin between the average first cost of the milk and the average selling price:

City.	Load per route.	Margin.	City.	Load per route.	Margin.
	Quarts.	*Cents.*		*Quarts.*	*Cents.*
Ottawa	550	3½	Baltimore	335	5¼
Philadelphia	410	4½	New York	265	7½

These loads, multiplied by the margins, closely approximate the same result, but it is evident that the dealer with the largest volume per route is able to operate with lowest expense.

Selling expenses cover the deliveryman's wages, wages of extra men and helpers, hostlers, mechanics, etc. The deliveryman's wages are paid in the following ways:

1. Straight salary per week.
2. Small salary and commission on sales.
3. Commission only.

It is the deliveryman's duty to distribute the products, collect the empty bottles, settle accounts, and care for his horse and wagon, or automobile. These men are expert sales and delivery men. They spend from 5 to 6 hours daily loading and delivering the milk, and on collection days they are on the route for 10 or 12 hours. They are not required to do hostler work but they do keep the accounts for their routes.

The International Milk Dealers Association has prepared cost accounting methods that may be profitably used by the dealer having 10 or more routes.

Some estimate and provision should be made to cover the losses due to accidents, stolen milk, broken bottles, etc., and $1 per route per day should be set aside for such leaks in profits.

[63238]

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U. S. Department of Agriculture.
Abstract No. 143.

WORLD'S DAIRY CONGRESS, 1923.

ABSTRACT.

SOME PROBLEMS OF MILK DISTRIBUTION.

By BEN DAVIES, United Dairies, Ltd., London, England.

This paper considers a few of the problems which are faced by distributors in providing urban communities with a good and regular milk supply. Its underlying suggestion is that the industry needs some organization for collating its experience and knowledge of milk questions, whether economic or hygienic, and applying them to the solution of outstanding problems.

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U. S. Department of Agriculture.
Abstract No. 144.

WORLD'S DAIRY CONGRESS, 1923.

ABSTRACT.

PROBLEMS BY WHICH THE CITY MILK DEALER IS CONFRONTED.

By JOHN LE FEBRE, President Gridley Dairy Co., Milwaukee, Wis.

Problems by which the city milk dealer is confronted are so closely allied with the health and development of our people that it is doubly imperative that he function fully in loyalty to the industry and his duty to mankind. This is not an easy task, because the various factors of which his business is composed fail to work with that spirit of unity so necessary to the welfare of any great commercial undertaking.

First of these factors to be reckoned with is the farmer—or the producer. As we all know, the farmer works hard for all he gains and the profits from his labors are comparatively small. The success and amount of his production are subject to so many hazards over which he has no preclusion that it is only natural that he becomes intensely concerned in the returns he realizes on his work. This is chiefly the basis of any contention arising between the producer and the dealer.

It is to the advantage of the dealer as well as the farmer that there should be a mutual feeling of confidence and cooperation. In our own plant we have tried to inspire this spirit by inviting our producers in to inspect the plant, talking over questions that may effect better results for both sides, and. in general, let them know we have an honest concern in the promotion of their work as well as our own. We also try to show them how the large profits they suspect we make are cut down by correspondingly large overhead expenses, of which previously they had no idea, and in this way we demonstrate that our own profits are no greater than theirs.

Strict sanitary measures, which double the cost of handling and distribution, the costs connected with purchasing, hauling, and labor, seasonal shortage and surplus, and standardized equipment are among the other factors that play important rôles in the business of the milk dealer.

During the recent war the milk distributors were among the many classes of food producers subjected to "profiteering" investigations.

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The expert accountants employed by Mr. Hoover to investigate the milk trade in 40 of our larger cities revealed the astonishing fact that instead of selling his products at 300 to 400 per cent above the pre-war prices, as most other foods were being sold, the milk dealer advanced the cost to the consumer only in exact ratio to the increase in price he was paying the farmer, and that the dealers' profits, if anything, were even less than those made before the war.

In spite of condemnation both from the consumer and the producer, the dealer keeps steadily on his course, subduing obstacles as they arise, doing the best for those he serves, dealing squarely with the world, and striving by every means at his command to inspire an enduring spirit of confidence.

[62810]

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62810—23

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[62810]

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U. S. Department of Agriculture.
Abstract No. 145.

WORLD'S DAIRY CONGRESS, 1923.

ABSTRACT.

METHODS OF BUYING AND SELLING MILK.

By CHARLES G. MORRIS, President New Haven Dairy Co., New Haven, Conn.

This paper is a survey of the development of the relationship between milk producers and milk dealers from the time when that relationship was one of individual and sometimes destructive bargaining to the most recent form of collective bargaining. The space allotted for such a paper forbids any attempt to cover the infinite variations of detail which took place during the development in different localities It has been equally impossible to describe in any measure of detail the many interesting modifications of the more recent plans of collective contracts which have so far been developed. This paper has, therefore, been confined to the statement and outline of a study of the economic forces which have appeared most conspicuously in the development of the business of furnishing fluid milk for city use.

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U. S. Department of Agriculture.
Abstract No. 146.

WORLD'S DAIRY CONGRESS, 1923.

ABSTRACT.

ECONOMIC AND SOCIAL FACTORS IN PRICE CONCILIATION IN THE MILK INDUSTRY.

By CLYDE L. KING, Secretary of the Commonwealth of Pennsylvania.

In the last 30 years there has been a marked increase in industrial conciliation. Parties to a contract have now found it practicable to call in a third party to act as arbiter in settling disagreements, and the milk industry, among many others, has found conciliation and arbitration both advisable and effective.

It is the purpose of this paper to discuss briefly the forces affecting price conciliation in the milk industry through the adjustment of misunderstandings between the producer and the distributor, and the distributor and the consumer.

Present-day business enterprise has pointed out that where results are to be achieved there must first be concerted effort; thus it is that we find organized bodies among the producers and distributors, and to some extent, among the consumers.

When urban populations were small the farmer could dispose of his dairy products directly to the consumer in the near-by town. As cities increased in size the farmer became more and more removed from his buyers until he could no longer economically market his own product, and the sale of milk in cities was taken over by the professional milk distributor. By selling his products to the distributor, the farmer became dependent upon the latter for the prices obtained. In order to establish a stable market, regular returns, and fair prices, the farmers soon found it to their advantage to organize in view of collective bargaining for their products. The success of this organization is exemplified by hundreds of cooperative associations throughout the country.

Likewise, milk purchasers in any large territory have the same problems relative to obtaining and handling milk and they, too, have gotten together on many projects. This does not mean that there is no competition between distributors, but that the competition is used to acquire better results, such as establishing uniform prices and profits, increased production and improvement in the quality of the

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products. In this way competition takes the form of service and quality.

Lastly, the consumer seeks protection of his interests. Although consumers are not, as a rule, organized for collective bargaining, they too, have their means of obtaining price conciliation, namely, through the public press. Through this agency they can bring about investigations of price, can boycott profiteers and attract distributors from distant centers. The consumer is no longer the victim of local conditions. Quick transportation with adequate cooling facilities has made the fluidity of the milk market the chief protection for the consumer.

In summation, the producer wants a steady market at a reasonable profit for his work, the distributor wants volume and a corresponding margin, the consumer wants a pure, wholesome food at a reasonable price. Briefly, these needs may be satisfied by (1) educational work in the city as to the food value of milk, (2) cooperation among producers to get a product worthy of wider public consumption, and (3) the help of middlemen to keep down their costs, both as insurance for stability and to meet public needs, so that a market can be developed with sound competition and fair prices to all.

[62819]

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U. S. Department of Agriculture.
Abstract No. 147.

WORLD'S DAIRY CONGRESS, 1923.

ABSTRACT.

A STUDY OF THE MILK TRADE IN AND ABOUT LYONS, FRANCE.

By R. GUYOT-SIONNEST, Secretariat Central du Lait, Lyons, France.

The community of Lyons has a population of some 700,000 inhabitants who consume 120,000 liters of milk per day in winter and 95,000 liters per day in summer. In winter the scarcity of milk makes it necessary to obtain more from Jura and Savoy. In summer there is an excess of milk due to a decrease of about one-sixth in consumption and an increased production of about one-fourth. The sale of the milk is difficult for the producers, and because of lack of help they are not able to make the excess into butter and cheese.

Organization of the dairymen.—1. The Modern Dairy Co. is an active industrial enterprise that handles, through its various district stations (between 50 and 60), 40,000 liters per day. In the summer it ships milk to Marseilles which is always in need of milk, due to the high expense of keeping cattle.

2. The Lyons Cooperative Dairy receives 20,000 liters per day; like the preceding organization, they are able to manufacture their milk.

3. Three syndicates of small dairymen (these selling from 50 to some hundreds of liters per day to small groceries, delicatessens, etc.). They are not organized for the conversion of milk into other products. Their milk is pasteurized by an independent plant which furnishes the heat, materials, etc., at a charge of 30 centimes per lots of 16 liters. The dairyman furnishes his own helpers.

Organization of the producers.—In 1921 there were two important groups. At that time the dealers had subjected the producers to successive cuts in prices until they were unable to make sufficient profits to cover the cost of production. This paved the way for organizations which could cope with the middlemen.

At the present time there are seven of these groups, located along the railroad lines which serve their communities. Several of these groups are collecting centers for their respective districts.

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All of these organizations, or unions, are under the direction and development of the Union of Southeastern Agricultural Syndicates (900 syndicates, 200,000 members).

Milk production.—This is rated at about 1,800 liters per cow (but lowered to 1,200 if the cow is worked in the field). Within 100 kilometers of Lyons there are some fine breeds, namely, Charollaise, Montebeliarde, Tarine, Villard-de-Lans, but because of the crossing of these different types of animals in the neighborhood of Lyons and those coming from a distance—the Normandy, Hollandaise, etc.—the crossbreeds are so numerous that the animals do not possess a fixed conformity. There is a marked tendency to adopt the Montebeliarde as the typical breed. Our sole purpose being centered on the production of milk, we have tried to assist in improving the herds by introducing good bulls regardless of the various individual qualities of the breeds.

Collection of the milk.—This is done in the following ways: (1) By collectors under the direction of the various syndicates; (2) by employees from the large dairy companies; (3) by a middleman. From the first two classes the costs run about 0.2 to 8 centimes per liter, depending upon the length of haul, condition of the roads, etc. The cost of transporting the milk by rail is about 3 centimes per liter.

Secretariat Central du Lait.—This is an organ dealing with the study and investigation of milk and it is placed in the hands of the dairy farmers. It aids them in selling their products under better conditions, informs them of the improvements being introduced in the milk trade, discusses the questions of interest to the trade; sale of milk in France and other countries, means of transportation, legislation for adulteration and the causes affecting the composition of milk, retail prices, etc. In a word, it tries to inform the producer on all questions pertaining to milk.

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Abstract No. 148.

WORLD'S DAIRY CONGRESS, 1923.

ABSTRACT.

THE METHODS OF MILK COLLECTION, TREATMENT, AND DISTRIBUTION USED BY THE BELFAST CO-OPERATIVE SOCIETY.

By J. HILL, Dairy Manager, Belfast Cooperative Society, Ltd., 20 York Street, Belfast, Northern Ireland.

The society's board of management as far back as 1912 was not satisfied with the new milk supply for the city of Belfast. The quality was not always what it should be. The delivery from door to door in open cans left a great deal to be desired.

The uncertainty of a sufficient supply caused the management to make preparations and erect what was in 1913 the most up-to-date dairy known. The plant consisted of a cleaner, pasteurizer, cooler, bottler, and cold store capable of handling 440 gallons per hour.

A great deal of prejudice existed in favor of natural or untreated milk. In order to combat this, the society carried on an educational campaign and as the lack of knowledge decreased, the sales increased until, in 1916, the handling capacity of the original dairy was doubled. To keep up with the better methods of dealing with the milk problem, the management, in 1921, erected a retarder (continuous-flow type) holding the milk for 30 minutes at 145° F., with a capacity of 880 gallons per hour.

To remedy the serious trouble and added expense of securing a sufficient supply of milk during the scarce period between October and February, it was decided to purchase about 20 per cent over requirements during the summer months. To care for this surplus milk during the summer, a churning plant was erected, and the milk made into butter. Both butter and buttermilk find a ready sale.

In 1923, the 20,000 gallon per week line was reached and the management decided to provide accommodations for 50,000 gallons per week. Accordingly, another 880 gallon per hour plant was erected, in which are included a new positive batch retarder and automatic rotary filling and capping machines, capacity 1,760 gallons per hour.

The society acquired several of the best dairy farms in County Down, where the milk is produced under ideal conditions from the

best herds in Ireland. Each animal is certified free from tuberculosis. The milk is carefully treated and sold as baby's milk. Additional supplies are obtained from inspected, up-to-date dairy farms in the counties of Down and Antrim.

The milk is purchased on a fat basis, using 3.6 per cent butter fat as a standard. Meetings are held with farmer delegates twice each year to fix the price. The farmers provide their own cans which are washed and sterilized at the plant.

The milk is collected by six 4-ton cars and three ¾-ton cars, covering journeys from 12 to 40 miles daily. It was found that motor traction not only costs less than rail traction, but is more satisfactory.

Immediately on arrival at the dairy the milk is tested for acidity. It then passes through a special strainer into the receiving tank, flowing over the warmer at 90° F. into a low-speed centrifugal cleaner. The pasteurizer then heats it to 145° F. and passes it on to the auto-continuous batch retarder which holds it at 145° F. for 30 minutes. The milk is cooled to 40° F. before bottling, and held in cold storage at 35° F. until delivery. This insures a safe and pure milk.

The city is divided into 27 districts, each of which is supplied with bottled milk from horse-drawn vans; the suburbs, into three districts supplied from motor vans. Thirteen depots sell bulk milk at 1 penny per quart cheaper than bottled milk.

The officials and staff profiting by past experiences mean to hold on and press forward to the 50,000 gallon per week line inside the next five years. To bring this about, an extensive advertising campaign has been planned.

There should be time set apart in all primary schools in agricultural districts for teaching the fundamentals of dairying. The pupils in both country and city schools should be taught the food value, as well as the care, of milk.

If the World's Dairy Congress is bold enough to take this matter up with enthusiasm, in less than 10 years the dairy industry of the world will be revolutionized.

[62405]

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U. S. Department of Agriculture.
Abstract No. 149.

WORLD'S DAIRY CONGRESS, 1923.

ABSTRACT.

THE DIFFERENT SYSTEMS OF HANDLING MILK IN ITALY.

By Prof. GUISEPPE FASCETTI.

The quantity of milk needed annually for direct consumption in Italy is estimated at 18,000,000 hectoliters.

The average annual consumption is calculated at 45 liters per inhabitant.

In thickly populated centers of northern Italy, the consumption is greater. It varies from 1 to 2 decaliters a day for each inhabitant.

The commercial organization which supplies milk in Italy includes the most varied systems, according to the rate of production of milk, its consumption by the population, and the standards of living.

The simplest and most primative systems are still in operation in southern Italy, while in northern Italy rational and modern systems have been adopted, which may be summed up in the organization of large dairies in the cities.

These systems may be classified as follows:

1. Delivery of milk at the home of the consumer by single producers owning some cows.
2. Distribution of milk by middlemen owning milk shops for retail trade in the city.
3. Distribution of milk by large firms owning modern plants for the collection of milk from the farms in great quantity, this milk to be distributed among sanitary, well managed city shops, which either sell it or deliver it to homes by means of special trucks.
4. Distribution of milk by producers' associations or by companies through city dairies properly equipped. The milk is collected from the surrounding country over a radius varying from 10 to 20 kilometers.
5. Distribution of milk at great distances (from 100 to 600 kilometers) by the great industrial establishments of Lombardy (those of the provinces of Milan and of Cremona) for furnishing the milk supply to cities not sufficiently provided for by their surrounding territory; as, for example, Rome, Florence, Genoa, Triest, etc.

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It is needless to say that the hygienic treatment of milk varies according to the distance between the place of production and that of sale, both as to kind and intensity. For short distances the following treatment is adopted:

1. Filtration, refrigeration of the milk at 5+° C.

2. Filtration, pasteurization at 80° C. and following refrigeration of the milk from +5 and +10° C.

For furnishing milk at long distances, the following treatment is adopted:

1. Filtration, pasteurization at 80° C., condensation to one-fourth its volume, and refrigeration at 2° C.

Milk treated as above is sent to its destination in metal containers of 50 liters capacity, being transported in refrigerating cars. On reaching its destination, its former volume is restored by means of the necessary quantity of water.

2. Filtration, pasteurization, at 80° C. and refrigeration obtained by means of frozen blocks of milk placed in the milk containers.

In spite of the great progress which has been realized in Italy by means of these modren systems for the distribution of milk supplies, much remains to be accomplished, especially in those places where the population is still ignorant; therefore, the following suggestions are submitted:

1. That the Government favor and encourage a sanitary inspection of cows in their stables.

2. That every effort be made to abolish the old system of retail home delivery by the producer.

3. That in the large cities the installation of modern dairies be encouraged, as the latter alone are capable of organizing a perfect service which will supply the consumer with pure and hygienic milk under the constant and easy surveillance of the communal authorities.

4. That the Government encourage the establishment of such dairies by facilitating their functioning, placing at their disposition rapid and appropriate means of transportation, and exercising also a rigid control over the sale of milk to the consumer.

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Abstract No. 150.

WORLD'S DAIRY CONGRESS, 1923.

ABSTRACT.

THE EDUCATION OF THE PRODUCER TO THE VALUE OF A BETTER PRODUCT AS A MEANS OF INCREASING SALES.

By Dr. L. T. C. SCHEY, Government Dairy Counselor, Hoorn, Holland.

Means to carry on to this end are:

1. To increase the professional knowledge of the producers.

2. To further the payment of milk according to quality.

3. Inspection of the milk production and the treatment of milk at the farms.

4. Examination of the final products and payment according to quality. The cooperative concern lends itself best for the application of the measure indicated. Private industry may attain the end by bringing the quality and content of valuable components of the milk to bear as factors, when the milk is bought.

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Abstract No. 150.

WORLD'S DAIRY CONGRESS, 1923.

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1. To increase the professional knowledge of the producers.
2. To further the payment of milk according to quality.
3. Inspection of the milk production and the treatment of milk at the farms.
4. Examination of the final products and payment according to quality. The cooperative concern lends itself best for the application of the measure indicated. Private industry may attain the end by bringing the quality and content of valuable components of the milk to bear as factors, when the milk is bought.

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U. S. Department of Agriculture.
Abstract No. 152.

WORLD'S DAIRY CONGRESS, 1923.

ABSTRACT.

DANISH COOPERATIVE DAIRY ORGANIZATIONS AND THEIR WORK.

By S. SØRENSEN, Agricultural Adviser to the Danish Government, Washington, D. C.

The Danish dairy industry is highly organized through local, district, provincial and national organizations. Of most importance are the local organizations.

The cooperative dairy societies, of which there are at present about 1,400, are founded on a strictly cooperative basis. Each of these societies owns and operates a small creamery to which the members (from 100 to 200) have pledged themselves to deliver all of their milk except that used in their homes.

The following principles are maintained in the laws:

1. All members are jointly and severally liable.
2. The proceeds are divided in proportion to the amount of milk delivered.
3. Membership is open to all milk producers.
4. Each member has one vote.

The first of these societies was organized in 1882 and since that time the cooperative movement has revolutionized the dairy industry in Denmark. Through the local organizations and creameries it has been possible for the farmers to produce a uniform quality and to some extent organize the marketing system.

District associations.—Realizing that an exchange of experiences would be of great help in promoting the dairy industry, the cooperative dairy societies have combined in district associations, of which there are at present 23 with a membership of about 1,400 local creameries. Their purpose is to organize butter-scoring contests and arrange meetings where matters of interest to the dairy industry are discussed.

Provincial unions.—The district associations are united in provincial unions representing the main Provinces of the country. These organizations have a yearly meeting where matters of more importance are brought up, and they also take part in the arrangement of large provincial exhibitions.

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The National Dairy Association.—The three provincial unions form the National Dairy Association (De danske Mejeriforeningers Faellesorganisation) which represents the dairy industry in regard to legislation and other important matters of common interest at home and abroad. The association maintains a statistical department which gathers detailed information from each creamery in regard to membership, number of cows, amount of milk received, butter produced, expenses, etc.

Butter-Export Associations.—The chief aim of the dairy organizations has hitherto been the improvement of the technical side of the industry, the manufacture of butter and cheese, etc. The marketing side has been left to the local creamery and for a long time most of the butter was marketed through the merchants. From time to time some complaint was raised against the butter trade and in several districts the creameries established cooperative butter-export associations, of which there are at present 12. These associations now market about one-third of the entire output and have had great influence on the quality of the butter by promoting payment on basis of quality. The 12 associations are amalgamated in a national organization.

Danish Creamery Managers and Buttermakers Association (*Danask Mejeristforening*).—This organization, with a membership of about 2,000, has taken a prominent part in the development of the Danish dairy industry. The association has 32 county organizations which cooperate with the producers' district associations in organizing butter exhibits, contests, meetings, etc.

The national association publishes the only dairy paper in Danmark, "Maelkeritidende," and has taken a great part in securing better education of butter and cheese makers.

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U. S. Department of Agriculture.
Abstract No. 153.

WORLD'S DAIRY CONGRESS, 1923.

ABSTRACT.

SYSTEMS OF DAIRY FARMING AND THE DEVELOPMENT OF COOPERATIVE ORGANIZATION IN DAIRYING IN SCOTLAND.

By JOHN DRYSDALE, Secretary Scottish Agricultural Organization Society Edinburgh, Scotland.

The following systems are briefly dealt with in the paper:

Town dairies.—A system under which cows are kept in towns and entirely stall fed. These cows are only kept for a season or so long only as they produce a profitable yield and are then sold to the butcher. This system which is wasteful of cow life is being gradually supplanted for reasons given.

Butter making on the farms.—This system was largely practiced at one time on farms within a few miles of cities and industrial towns especially in the west of Scotland where it was the practice to retail butter and buttermilk from carts to the consumers. Home baking is now less practiced than formerly and there is less demand for buttermilk. Owing to the large importation of butter from abroad, butter making on the farm is now a less profitable proposition and this system is decidedly on the wane and giving place to the selling of fresh milk.

Cheese making on the farm.—This system is described and though still practiced extensively on the large dairy farms in the southwest of Scotland it has largely given place to the selling of liquid milk in the midland counties and in Ayrshire.

Proprietory dairy factories or creameries.—This system which was started toward the close of the nineteenth century principally in the southwest of Scotland and one or two other districts is briefly described.

Cooperative dairying.—This system which owes its origin to the Scottish Agricultural Organization, which was promoted toward the close of 1905, is fully described, and instances are given of how dairy farmers have benefited since its adoption.

Retail selling of milk.—This system practiced by suburban farmers is described and though cooperation has not so far appealed to any

great extent to that class of farmers a striking instance is given where the farmers who at one time retailed milk in a northern town have for some years, to their great advantage, conducted the distribution from their own cooperative milk depot, thus saving great loss of time, overlapping, and undercutting of prices.

New developments likely to result from the milk (special designation) order issued by the ministry of health are briefly referred to, merely to show that should there arise a demand for graded or pasteurized milk the organized farmers are in a good position to comply with the order from their cooperative milk depots, and will be prepared to install whatever modern plant may be necessary.

[62193]

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Abstract No. 154.

WORLD'S DAIRY CONGRESS, 1923.

ABSTRACT.

THE METHODS WHICH HAVE BEEN USED BY THE COOPERATIVE MARKETING IN HOLLAND AND THE RESULTS WHICH HAVE BEEN OBTAINED.

By R. M. VEEMAN, Vice President of the Frisian Cooperative Association for Export of Dairy Products, Leeuwarden, Holland.

1. The first condition for the most advantageous sale of an article is the continual improvement of the quality of the article itself.

2. Only when there is a close and regular relationship between production and sale will it be possible that all factors affecting the improvement of the quality will be achieved day by day.

3. The results mentioned above are only guaranteed by the cooperative form for production and sale, so that it will be possible at any moment to inform the producer of every characteristic, and at the same time of the exact value, of his article.

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U. S. Department of Agriculture.
Abstract No. 155.

WORLD'S DAIRY CONGRESS, 1923.

ABSTRACT.

COOPERATIVE CREAMERIES IN IRELAND.

By Irish Agricultural Organization Society, Dublin. Sir Horace Plunkett, President; R. A. Anderson, Secretary.

The dairying industry has from time immemorial been one of Ireland's greatest sources of wealth.

Prior to 1880 Ireland had virtually held undisputed supremacy as a butter-producing country. Butter was then made by farmers in their home dairies. At this juncture the centrifugal cream separator was invented and was put into almost immediate use in Denmark and Sweden. By its use the cost of manufacture was decreased, the volume of butter increased, and a degree of uniformity was attained. The Danes, by making great temporary sacrifices in price, secured the markets of London and Manchester.

Ireland was late in entering this world competition. Irish farmers, like those in other countries, are slow to change their methods. The change from farm dairying to factory operation seemed to them revolutionary, and they revolted at the idea. Many dairy farmers, finding buttermaking no longer profitable, sold their dairy cows and reverted to "dry-stock" farming. Many girls and laborers were thereby left without employment and some of them emigrated to America.

Canon Bagot then attempted to establish creameries with power equipment and started several in the south of Ireland, organized as joint stock companies. Proprietary creameries were also established. To-day not one of the Bagot type of creameries survives, while the proprietary concerns are gradually passing into the hands of farmers' cooperative societies.

In 1889 Sir Horace Plunkett started his cooperative crusade which aimed at making every Irish dairy farmer a cooperator. Progress, however, was slow, but with the assistance of the Irish Agricultural Organization Society since 1894, 445 cooperative creameries have been established. In 1921 their turnover was £5,661,518. The capital is subscribed mainly by milk-producing farmers; interest is limited to 5 per cent. All other profits are turned into pro rata dividends for the milk-supplying members and the workers in the

concern. Practically all of them contribute to the Irish Agricultural Organization Society. Many cooperative creameries have of late years added to their activities that of supplying the patrons with seeds, fertilizers, feeding stuffs, machinery, farm implements, and household requirements. Several have taken up the marketing of eggs and poultry.

Much has been achieved in Irish dairying since the introduction of cooperation 34 years ago. Critics of the movement state it has failed to achieve the following:

1. The loyalty of members to one another and to their society.
2. Any increase in the average milk yield of Irish dairy cows.
3. Any increase in winter production.
4. A system of cooperative marketing.
5. A rigid system of control or standardization of the process of manufacture.

Loyalty can only be expected when an improved system of education on practical lines is introduced and a thorough understanding of cooperative principles comes about.

The average milk yield of Irish dairy cows is to-day under 450 gallons per annum, which is where it stood in 1889. Irish dairy farmers could grade up their cows to a production of 600 gallons.

It is doubtful if winter production of butter in Ireland can be demonstrated to be an economical or a paying proposition.

The Irish Cooperative Agency Society has done much to organize a system of cooperative marketing. It is the largest shipper in existence of Irish creamery butter.

The successful cooperative marketing of butter, however, is dependent upon standardization of the process of manufacture. Irish butter, at its best, is the best butter in the world, but no country is putting forth so little effort to capture the markets of the world.

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WORLD'S DAIRY CONGRESS, 1923.

ABSTRACT.

COOPERATIVE CREAMERIES IN THE MISSISSIPPI VALLEY.

By O. A. STORVICK, Albert Lea, Minn., Western Representative of Gude Bros.-Kiefer Co., New York, N. Y.

Of the 1,153,515,000 pounds of creamery butter produced in the United States in 1922, 803,504,000 pounds, or 69.2 per cent, were made in the nine North Central Mississippi Valley States. The invention of power separators and the Bacock test, some 30 years ago, did much to stimulate the development of the dairy industry in this section by providing more adequate means for recovering the butter fat from the milk and for determining the butter-fat content of the milk itself.

Prior to 1890, practically all the butter factories were privately owned. Inasmuch as these factories were built for profit and the profit depended upon the size of the output, little effort was made to turn out high-grade butter and consequently the farmer was poorly paid for his cream. Certain agencies, representing themselves as cooperative organizers, attempted to promote so-called cooperative creameries. These companies were usually actuated by selfish motives and the cash dividends paid on the shares, rather than the prices paid the producer, determined the success of the company.

Progressive dairymen soon realized that in order to succeed it would be necessary for them to build and operate their own creameries on a cooperative plan. Although their legal agreements were ofttimes faulty, the principle upon which they operated was sound, and in a comparatively short time a number of creameries were in successful operation. The patrons soon realized that, as partners in a business, it was to their advantage to do all in their power to improve the quality of their products if they wished to get the best prices. This soon resulted in the recognition of the superiority of the butter produced by cooperative creameries.

The advent of the hand separator introduced a new creamery system, namely the centralized creamery system. Proprietary creameries that had previously found it difficult to compete with the quality of butter made from the whole milk in the cooperative

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creameries now found they could speedily transport the less bulky cream by rail and thus collect a high grade of cream from a large area in a short time.

The dairy and food commissioner of Minnesota, the largest butter-producing State, makes the following statement relative to the kind and number of creameries and the amount of butter they produce:

Year.	Number of cooperative creameries.	Proprietary.	Centralized.	Per cent of cooperatives.	Per cent of butter made by cooperative creameries.
1914	622	189	39	73.2	61.4
1917	643	159	39	76.4	61.7
1919	622	145	44	76.6	63.7
1921	645	139	47	77.6	67.1

Similar data are not available for Wisconsin and Iowa, the States rating next in butter production, but it is estimated that the figures would be approximately the same.

Among cooperative creameries, where every butter maker is the sole judge of the quality of the product from his creamery, it has been almost impossible to get a uniform quality of butter. This difficulty has been increased where separated cream is used and creams of varying grades and sweetness are combined for churning. After exhaustive experimentation, the United States Department of Agriculture, Dairy Division, has demonstrated that butter of fine, uniform flavor and excellent keeping qualities may be obtained from fresh, sweet, pasteurized cream churned without the addition of a "starter" or ripening agent. This sweet cream butter has met with such favor that the highest market quotations are paid creameries producing this type of butter.

The most important recent development among creameries is the organization of cooperative associations by creameries within their respective States. These organizations band the creameries together for closer cooperation both in the manufacturing and marketing of their butter. Assistance is given the creameries through the service of field men who endeavor to bring about greater efficiency in the operation of the creameries and also aid in the improvement of the quality and uniformity of the product. This cooperation also lends itself to the solution of shipping and marketing problems. Although these associations have been developed only recently, great benefits have already been indicated by the co operation between the producing and marketing agencies.

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WORLD'S DAIRY CONGRESS, 1923.

ABSTRACT.

THE COOPERATIVE MARKETING OF BUTTER ON THE PACIFIC COAST.

By C. L. MITCHEL, Efficiency Man, Challenge Cream and Butter Association, Los Angeles, Calif.

The Dairymen's Union (1891–1908) was the first attempt at the cooperative marketing of butter. Was at first successful, but gradually disintegrated. The Oregon Cooperative Dairy Exchange (1916–17) accomplished nothing and soon closed. Oregon Cooperative Dairymen's League (1917–1920) represented mushroom growth, proved impossible in practical operation, and broke with great loss. Associated Dairymen of California (1917–1922), represented an ambitious but impractical scheme, was poorly managed and ended disastrously. Challenge Cream and Butter Association (1911–1923) began very small but grew gradually and now has very large business. Cooperative marketing of butter is certain to increase in magnitude.

The paper explains the causes underlying the successes and failures of the various cooperative marketing movements covered.

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U. S. Department of Agriculture.
Abstract No. 159.

WORLD'S DAIRY CONGRESS, 1923.

ABSTRACT.

THE COOPERATIVE MARKETING OF CHEESE BY PRODUCERS—ITS DIFFICULTIES AND ADVANTAGES.

By THEODORE MACKLIN, Professor of Agricultural Economics, University of Wisconsin, Madison, Wis.

Cooperative marketing of cheese is being introduced in the United States successfully. The experimental stage of almost 15 years has proved the idea most excellent in operation. Through cooperative merchandising the cheese of Tillamook County, Oreg., won more than a 4-cent per pound higher net price than did Wisconsin cheese sold on the same markets. This net premium of 20 per cent above Wisconsin delivered prices is explainable only by the high grade of service rendered by the cooperative system employed throughout the making, standardization, and merchandising of the product.

Tillamook has excelled over Wisconsin because the cooperative system consolidated cheese factories into larger enterprises well able to meet the additional expense of employing only first-class cheese makers, who in turn are enthusiastic about working as a team of 25 to rigidly standardize their total output. Moreover, they have each turned over to the general sales manager the entire responsibility of marketing the output. This insured a volume of worthy product that easily justified not only any necessary expense of merchandising the article, but also insured that this merchandising would be of unexcelled excellence so far as the cheese industry was concerned.

Wisconsin is developing a cooperative marketing organization which seeks to apply the same principles practiced by the Tillamook organization. Its history of nine years' operation brings it now to a point where it is applying some of these principles and is rapidly approaching a time of applying all of them. Within recent years several private organizations have been developing merchandising programs of wide significance. These act as a stimulation to cooperative endeavor. They also act as a competitive check to rapid cooperative growth and accomplishment. Obviously this makes Wisconsin cooperative performance in cheese marketing somewhat less spectacular than the accomplishment in Oregon.

The great advantage of successful cooperative cheese marketing, such as that already demonstrated in Oregon and that on the verge

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of realization in Wisconsin, is that it applies all of the practical and scientific principles of marketing as a servant of the farmer to win results for him primarily instead of having these principles work as a slave of private initiative to satisfy first of all the narrower interests of middlemen. Through the cooperative system, cheese farmers may know that the farm price received is the best that conditions permitted. No reasonable farmer expects more than this. When better results are sought, knowing that cooperative marketing gives the best prices possible, cheese producers gain self-conviction that the business management of the farm and the quality of the product must be improved if profits are to be further enlarged.

While the advantages of cooperative marketing of cheese amply justify its application widely throughout the industry, there are disadvantages surrounding its practice which should be more commonly understood if these weaknesses are to be overridden rapidly and easily. They pertain to the nature of cooperative organization and individual relation thereto rather than to the ability of the cooperative plan to function efficiently in a business manner. In short, the trouble with cooperation is in the lack of cooperators. Cooperation means teamwork. Teamwork requires understanding of duties, signals, tactics, standard of performance, and other details that become known only by a combination of doing and studying. The process of propagating or expanding a cooperative system for cheese marketing has for these reasons been slow. Tillamook history covers 19 years. The Wisconsin Cheese Producers' Federation has been growing through almost 10 years. Growth has been retarded because expansion had to await the making of cooperators out of highly individualistic and independent dairymen. Even after people thought they were cooperators enough to join the organization, neither the leaders nor the followers knew what policy to follow in the operation of the business. As a consequence, leaders hitherto untrained in the technical business of cheese merchandising had to learn this business and find out what they regarded as worth doing. This determined, the mass of membership had to be convinced that a real, comprehensive cooperative marketing system is worth building, supporting, and perfecting.

To-day the atmosphere in Wisconsin is fogged with the constant propaganda of conflicting interests. In the lack of courageous, clear, constructive, and adequate education the cheese producers are having a hard time making up their minds about what to do. The prospects are for cooperation to expand as rapidly as the cooperative management is able to prove the worthiness of the principle by its results against competitors.

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WORLD'S DAIRY CONGRESS, 1923.

ABSTRACT.

BUILDING A CHEESE INDUSTRY IN NEW TERRITORY THROUGH COOPERATION.

By V. D. CHAPPELL, Associate Professor of Dairy Manufactures, Oregon Agricultural College, Corvallis, Oreg.

The Tillamook County Creamery Association is known to be one of the most successful organizations of its kind in existence. The method of manufacture is so perfected that less than one-half of 1 per cent of over 6,000,000 pounds of cheese made in 1922 scored below first grade. The system of marketing is considered to be very efficient, as is indicated by the fact that the cheese sold in 1922 at an average of 6½ cents per pound above the price of Wisconsin cheese. The cost of marketing Tillamook cheese is held at the lowest possible point by selling to brokers in large Pacific coast markets who sell on commission only. Warehouse and storage expenses have been eliminated by making direct shipments to markets from the factory in which the cheese was made.

Previous to 1902 there were 40 creameries and cheese factories in the county. During the fall of 1902 Carl Haberlach became secretary of the Tillamook Creamery Association, one of the largest cheese factories in the county. He immediately began to give special attention to marketing. He met with such success that gradually other factories asked him to do their selling also. As he took on one factory after another he had sufficient volume to control prices for that section. In 1909 he was secretary-salesman for 9 factories, and with such a variety of cheese he had many complaints on quality. In order to meet this difficulty, the Tillamook County Creamery Association was organized, which was composed of the 9 largest factories in the county. Carl Haberlach was appointed secretary-salesman and F. W. Christensen cheese inspector. This combination produced results. The regular inspection improved the quality, making the selling more easily handled. From time to time other factories came into the association until, at the present time 25 factories are represented. Each factory has one member on the board of directors of the county association, which meets once a month with the secretary-salesman.

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The farmers of the county have realized that in order to maintain the reputation of Tillamook cheese the quality must be held at the highest possible standard. It is this attitude, along with the cooperative spirit, that has made it possible to employ a county agent, a county milk inspector, and a county veterinarian. The cheese inspector in scoring cheese from each vat of milk often finds objectionable flavors due to some local conditions. He then reports to the milk inspector and county veterinarian and it is a matter of a short time until the difficulty is eliminated. These inspectors, working in perfect unity, have had much to do with developing the quality of Tillamook cheese.

When Tillamook cheese came on the market a demand for eastern cheese had already been established on the Pacific coast. As the production of Tillamook cheese increased it was necessary to increase the demand for it. A very extensive advertising campaign is being made which is financed by an assessment of four-tenths of a cent per pound of cheese. The fact that Tillamook cheese sold for $6\frac{1}{2}$ cents above Wisconsin cheese price during the year of 1922 would indicate that this advertising was decidedly effective.

The isolated condition and cooperative spirit of the Tillamook farmers, efficient management and marketing, and high quality of Tillamook cheese are the factors that have had considerable to do with the great success attained by the Tillamook County Creamery Association.

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Abstract No. 161.

WORLD'S DAIRY CONGRESS, 1923.

ABSTRACT.

COOPERATIVE MANUFACTURING AND MARKETING OF DAIRY PRODUCTS.

By J. A. SCOLLARD, President, United Dairy Association of Washington, Seattle, Wash.

Explanation of cause leading up to establishment of cooperative milk products plants in Washington State. How the plants erected by the associations were built and equipped to give flexibility and balance to output of various dairy commodities according to market conditions. Description of plants, equipment, and processes. Methods employed in field work and inspection of raw products. Advantages of cooperative operation over private operation in improving quality of milk and cream shipped. Volume of raw product received and variety of products manufactured. Why our butter has created a special classification. Whole-milk extras. Difficulty of securing uniformity in cheese produced in factories in different territory. Milk powder—our system of manufacturing—our methods for securing uniformity in different factories and territories. Whole-milk powder; skim-milk powder. Canned evaporated milk—regulation of factory output. Labels. Canned evaporated skim milk—its limits and outlets as we find them. Sales of canned milk direct to retailer and through jobbers. Butter and cheese—our sale system. Skim-milk powder—system of selling our large output, domestic and foreign. Price levels of raw products before and since we became a factor in our field. The effect of our operations in encouraging expansion in dairying.

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Abstract No. 162.

WORLD'S DAIRY CONGRESS, 1923.

ABSTRACT.

ADVERTISING TO INCREASE THE CONSUMPTION OF DAIRY PRODUCTS.

By Maj. P. F. O'KEEFE, President of the P. F. O'Keefe Advertising Agency (Inc.), Boston, Mass.

The increase in dairy products in New England as shown by railroad figures and the number of dairy herds, illustrates what advertising can do to bring about greater consumption of dairy products as food. No States can boast as high a cow population per capita as that of New England. Wherever the dairy industry has been given the helping hand of advertising as it has in New England, volume has increased and dairy herds have multiplied. Boston, where the advertising has been chiefly centered, used more milk than any other American city.

Railroad figures show the supply of milk and cream has grown almost 85 per cent during the past 10 years. The advertising done by the New England Dairy & Food Council is now in its fourth year and figures for the month of May (the latest figures to be received at this writing) showed an increase of 1,000,000 pounds in the city of Boston alone. This shows that the dairy farmers should be keenly interested in advertising because it has increased the need of milk and has made possible new methods of marketing dairy products.

Cooperation on the part of the dairy industry is quite feasible to bring about more economical methods of selling, and to achieve publicity through advertising which will increase the volume.

Advertising is simply mass selling. The first three months of the Boston milk campaign showed an increase of 2,000,000 quarts among four dealers, compared with the same period of the previous year.

What has been done for the raisin industry, fruit industry, oranges, lemons, walnuts, and other food products can be done for milk.

Due to advertising, the consumption of oranges was increased 300 per cent in a period of seven years. Besides increasing the consumption of fruit, advertising has decreased the cost of marketing. Ten years ago the average cost of marketing the orange crop was 5.51 per cent of the delivered value of the crop. The average cost of marketing in 1920 was only 2.01 per cent. The saving in one year

was almost enough to pay the entire cost of the advertising. It is believed to be the lowest marketing cost of any perishable food product found in America.

The capital wealth of the California fruit farms runs into the thousand millions. Advertising has paid off mortgages, has brought deserved prosperity to California cooperators. And advertising has not raised prices of their products.

What cooperative advertising has done for the producers of citrus fruits, almonds, walnuts, apples, cranberries, peaches, flowers, etc., it will do for milk, cream, butter, and cheese.

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ABSTRACT.

DEVELOPMENT OF THE CENTRAL CREAMERY.

By T. A. BORMAN, General Territory Manager, Beatrice Creamery Co., Chicago, Ill.

The central creamery, commonly called "centralizer," obtains its cream supply from an area so large as to require rail transportation. It has complete modern facilities for the churning of large quantities of uniformly made butter, and largely markets its output directly to the consuming trade.

The cream supply of such central creameries is obtained through one of the following three plans or combinations thereof:

1. Through cream receiving stations located at rail stations convenient for the farm dairyman. At these receiving stations each delivery of cream is immediately paid for. This is the "cream station" plan.

2. Through cream shipped by rail by the farm dairyman in his own can directly to the central churning plant. His check is mailed for each delivery. The shipping can is washed and returned by rail. This is known as the "direct shipping" plan.

3. Through collecting cream at regular intervals at the farm of the dairyman, and employing either or both wagon or rail transportation to the creamery. This is the "route" system.

The first central creamery in the country, it is believed, was established at St. Albans, Vt., about 1895. Its cream supply was from whole milk centrifugally separated at skimming stations. The farmers in States west of the Mississippi River, who, up to that time, had been without a remunerative and permanent market for dairy products, adopted this plan of creamery operation in the early nineties—Kansas, Oklahoma, and Nebraska were the first States.

During 1900 to 1905 the "skimming station" was succeeded by the farm cream separator, which came into practical development at about that time. Its economies were those which the farmer had long been seeking, and with it a new type of farm dairying developed. The central creamery became a definite, permanent, and potential actor in our dairy development.

This plan of creamery operation extended rapidly to all the States lying west of the Mississippi River. At this date there is no State

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having a dairy industry in which the central creamery is not an increasingly important factor. It is estimated that more than half of the creamery butter produced in the United States is made in central creameries.

The central creamery has accomplished much in developing the science of butter making. The product of the farm cream separator was a new and unknown raw material for butter making, and it was for the central creamery to develop methods, and machinery as well, for its economical handling and manufacture into a satisfactory product. It attracted, and in fact demanded, the attention of the best minds in factory, dairy school, and experiment station, and to them the dairy industry of the world is much indebted.

The central creamery brought to the consumer a more satisfactory butter in every particular than that he had been able to secure before. Its uniform goodness, flavor, body, and color, and its superior keeping quality were sources of satisfaction he had not experienced previously.

Ordinarily, the central creamery is a marketing agency for its own output, and as such has solved many heretofore perplexing problems to the complete satisfaction of the consumer. Through its distributing agencies receiving regular supplies by the most favorable methods of shipment and storage, through regular deliveries to the trade, and other features which succeeded the unsystematic methods of middlemen and butter cutters with their hit-and-miss delivery systems, permit the central creamery, at a minimum of expense but with an unexcelled service, to place butter in the consumers' hands in the best possible condition.

The central creamery system evolved from an actual need. It grew out of the pursuit by the farmer of every then known method of creamery operation, but which had failed to meet his requirements. While originally its purpose was that of providing for the producer a permanent and satisfactory outlet for his cream it was not expected that it would prove an equally great benefiting factor for the consumer.

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ABSTRACT.

SOME FACTORS RELATING TO THE PRODUCTION OF CREAM FOR BUTTER MAKING IN NEW ZEALAND.

By W. DEMPSTER and G. M. VALENTINE, Dairy Instructors.

The introduction of milking machines and the adoption of home separation have brought about considerable changes in the production of cream for butter making in New Zealand during recent years.

With the growth of the dairy industry and the increasing number of large herds labor became scarce and the introduction of mechanical milkers made an appeal to the operators of large dairies, but it was not until some years later that the influence of the milking machine was felt in the general industry. The construction of suitable milking sheds which would permit the work to be dispatched quickly and the invention of the releaser, whereby the milk is conveyed under partial vacuum through pipes direct from the machine to the milk cans or separator tanks, were the first improvements made.

The first noticeable effect of the use of mechanical milkers was the drop in the quality of cream received at the factories. The failure of the operators to keep their machines and piping clean and in good condition, and the use of black or galvanized iron piping caused this early defect in the quality of the cream.

Before the milking machine is attached to the cows, cold water should be run through the entire system to prevent milk from adhering to the sides of the pipes. Immediately after milking, while the pumps are still running, cold water, then a warm solution of washing soda or other cleanser, and lastly boiling hot water should be run through the entire system to insure proper cleansing. It is recommended that once a week the whole machine be dismantled and thoroughly washed; all rubber parts should be sterilized in a caustic soda solution.

With the increased use of mechanical milkers cream separators came into almost universal use until now about 80 per cent of the cream used for butter making is separated on the farms. In most plants the separating is carried on simultaneously with the milking, the cream is run from the separator over the cooler and then stored in containers until sent to the factory.

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The various causes of contamination and bad flavors in cream are discussed with means for remedying the same.

When cream is received at the factory it is immediately graded as superfine, first, or second grade. Superfine cream is paid one-half to 1 penny higher per pound above first grade, while second grade receives one-half to 2 pence lower than first grade. A deduction of one-half penny is also made in some factories for cream testing below 35 per cent butter fat.

This system of grading, combined with the instructions given the farmers by instructors sent out from the creameries, has been very successful in raising the quality of butter produced. The instructor, by personal inspection of the cream on the factory receiving platform, notes the cream which is defective and proceeds to the farm to locate the trouble. If the processes on the farm are not conducted as they should be, or if the farmer is ignorant of correct methods, it is the duty of the instructor to give demonstrations and advice to the dairyman. If the dairyman insists he has done everything possible to produce good cream and still fails, the instructor takes over the management of the dairy until the trouble can be located. Generally the instructor is welcomed by the dairyman but in those instances where there is resistance to the necessary improvement, the instructor is authorized by the company employing him, or by the ministry of agriculture, to close the premises until the dairy comes up to specifications.

Factories working along these lines are able to produce butter quite equal in quality to that formerly made from the whole-milk system, and under proper control, the home separator has proved of great value in New Zealand, especially in opening up new districts where without it the industry could not have reached its present volume. The milking machine also has played an important part in the same direction through minimizing the dependence upon labor. This was notable during the war, when in spite of the large number of men engaged in war work, the dairy products of the Dominion were not only maintained but increased.

[62237]

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Abstract No. 166.

WORLD'S DAIRY CONGRESS, 1923.

ABSTRACT.

THE COMMERCIAL SIGNIFICANCE OF THE VARIABLE CONSTITUENTS OF CREAMERY BUTTER.

By J. R. KEITHLEY, Division of Dairy Husbandry, University of Minnesota, Minneapolis, Minn.

Both quality and composition of creamery butter vary widely. Such variation is of great commercial significance. The quality varies due to minute quantities of substances which to a large extent baffle both the chemist and bacteriologist as well as the manufacturing specialist or business man. The variable quantities of these minute substances determine the grade of butter and the price received for it. The composition varies probably even more widely than the quality and is of almost equal commercial significance because it is more easily under the control of the manufacturer and determines the quantity of butter obtainable from a definite amount of butter fat.

This paper is concerned with the commercial significance of (1) the quality and (2) the composition of butter.

Commercial significance of quality in butter.—The commercial significance of quality is indicated by the following data: There are produced annually in the United States of America approximately 1,054,000,000 pounds of creamery butter. This butter is divided into grades on the basis of its score and commands a price in the market on the basis of grade. This is best and most briefly shown by tabulated statement as follows:

Percentage of all butter.	Grade score.	Average prices for the year.		
		1920	1921	1922
		Cents per pound.	*Cents per pound.*	*Cents per pound.*
2	93	62.39	44.29	41.29
3	92	61.21	43.33	40.52
10	91	59.98	42.27	39.40
20	90	58.16	40.55	37.75
25	89	55.77	39.09	36.29
25	88	54.49	37.54	35.30
10	87	52.46	36.08	34.00
5	86	50.79	34.50	32.40

If all butter made in Minnesota had scored 93 and brought 93 score price the returns to the dairy interests of the State would have been

greater in 1920, 1921, and 1922 by $9,045,332, $8,870,560, and $8,289,560, respectfully.

Commercial significance of composition of butter.—The commercial significance of composition of butter is indicated by the following data obtained by an analysis of 2,050 samples of competitive contest butter from creameries throughout Minnesota. This data is best and most briefly summarized by tabulated statement as follows:

Constituent.	Maximum.	Minimum.	Average.	Number of samples and color on Nafis rod.	Storch test for peroxidase.
Water	24.2	9.2	13.926	839 A	666+
Fat	88.9	70.6	83.346	1,268 B	272+
Salt	4.1	.1	1.770	151 C	989—
Curd	2.5	.2	.852	19 D	....

These results show a neglect of composition control work, and if taken as typical of the 170,000,000 pounds butter produced in Minnesota, indicate that 7,110,250 pounds more butter would have been made if it had been standardized to 80 per cent fat. This butter, at the average price of 36 cents for the year, would have yielded $2,559,690 greater income to the dairy interests.

CONCLUSIONS.

1. The quality of butter depends upon minute quantities of substances which to a large extent still baffle the chemist, bacteriologist, and manufacturing specialist. Its commercial significance is tremendous.

2. The composition of butter varies widely. Similar variation was found in samples of butter from three sources, viz, competitive contests, creameries, and New York market.

3. A large proportion of American creamery butter contains fat above the legal and market requirements, and, if typical of all butter produced in creameries, means a tremendous loss to the dairy industry in all butter-producing countries.

4. The control of the composition of butter will be more easily attainable than that of quality, because it is centered in the hands of fewer men.

5. Briefly stated, it seems probable that the commercial value of the variable constituents of creamery butter exceeds $10,000,000 annually on each 170,000,000 pounds of butter produced unless careful control methods are followed.

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U. S. Department of Agriculture.
Abstract No. 167.

WORLD'S DAIRY CONGRESS, 1923.

ABSTRACT.

THE FORMATION OF BUTTER IN CHURNING.

By OTTO RAHN, Head of Physics Department, Prussian Dairy Research Institution, Kiel, Germany.

Soxhlet's old churning theory, dating from 1876, is based upon assumptions which have proved, in the course of time, to be wrong. Soxhlet supposed that the fat of the cream remained liquid, that liquid fat globules did not stick together, and that the concussion in the churn was necessary to solidify the fat and thus form the butter. Since then, it has been shown that the fat of normally cooled cream is solid before the churning begins, and that even liquid fat at 32° C. may be transformed into butter.

The theory here advanced tries to explain the formation of butter through surface powers. Milk has a lower surface tension than water, largely on account of some proteins. According to the law of Gibbs and Thomson, the substances reducing the surface tension must accumulate in the surfaces. The largest surface of milk is that against the fat globules which amounts to at least 25 to 30 m^2 per liter. The fat globules must be surrounded by a very thin film of protein, and this has been proved analytically by the higher nitrogen content of cream and butter as compared to milk. The protein films of the fat globules are not solid, but viscous, and they cause a natural gathering of the fat in raw milk. These accumulations bring about the rapid formation of cream, while in heated milk all globules remain single and therefore, rise but slowly.

Another kind of surface originates in the milk foam. The proteins must accumulate in these foam membranes as well, and analysis proves, indeed, that the milk foam contains more protein than the milk itself.

The formation of butter may be explained as follows: In churning, air is dispersed in the cream, and a foam is formed. The protein lowering the surface tension must accumulate in the newly produced surfaces, i. e., the foam membranes, and since this same protein surrounds the fat globules, these are drawn into the foam and held there. Analysis shows that the liquid cream underneath the foam is gradually decreased in fat. In the foam, the fat globules lie very

close together, under the pressure of the two surfaces, and thus fat clusters originate at first. These clusters are readily transformed into lumps if the fat is soft enough to yield to the pressure, and these lumps stick together and thus rapidly increase in size. Finally the butter "breaks," the foam collapses, either because the butter lumps become so large as to disturb the surface equilibrium, or because the protein in the foam membranes solidifies and thereby loses its elasticity.

All substances influencing the surface tension of milk, or changing the films of the fat globules as, for example, alkali, retard or inhibit the churning. The high fat content of buttermilk at high churning temperatures is caused by too rapid a formation of butter lumps before all the fat globules have been worked into the foam.

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WORLD'S DAIRY CONGRESS, 1923.

ABSTRACT.

THE IMPORTANCE OF THE EQUILIBRIA IN THE SYSTEM MILK FAT IN THE MAKING OF BUTTER.

By Dr. W. VAN DAM, Director of the Chemical Department of the State Agricultural Experiment Station at Hoorn, Holland.

When pasteurized cream is cooled to churning temperature, the fat of the fat globules begins to solidify. The lower the temperature and the longer the time of the cooling, the farther solidification proceeds. Every butter fat has a definite state of equilibrium corresponding to a definite temperature. This state of equilibrium, however, is not reached merely by exposing the cream to a certain temperature for 24 hours or even much longer.

Dilatometric experiments have shown that after cooling for 24 hours the approach to the state of equilibrium is still so far from being completed that equilibrium is not found to exist till after heating to a temperature which is about 10° C. higher. If, therefore, we wish to be sure that the fat of cream which is to be churned at, say, 12° C. is in a state of equilibrium at that temperature, the cream must be cooled beforehand to about 2° C. for a considerable time.

The question, whether producing a state of equilibrium in the fat will be profitable as compared with the usual practice of souring at a low temperature, must, beyond every doubt, be answered in the affirmative. The experiments made in this connection proved that at a given churning temperature the buttermilk can only be got to contain a minimum amount of fat if, when the churning begins, the fat is in the state of equilibrium corresponding to that temperature. This rule holds for any churning temperature.

CONCLUSIONS.

For any temperature at which the cream is churned the rule holds that a minimum amount of fat will go into the buttermilk only if, before churning, a state of equilibrium has been produced in the system milk fat.

In order to be quite certain that this state of equilibrium has been brought about, the cream must be cooled for a considerable length of time to about 10° C. below the churning temperature.

Raising the souring and the churning temperature has a less injurious effect on the amount of fat in the buttermilk and the consistency of the butter when the state of equilibrium has first been produced in the milk fat than when this has not been done.

Cooling to a very low temperature, by which the loss of fat in the buttermilk is diminished and by which the butter maker is enabled to sour at a higher temperature and to produce a firmer butter, is in every way recommendable in summer in the Low Countries.

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ABSTRACT.

FISHY FLAVOR IN BUTTER.

By H. H. SOMMER, Ph. D., Assistant Professor of Dairy Husbandry, College of Agriculture, University of Wisconsin, Madison, Wis.

Fishy flavor in butter is a defect that occurs mainly in storage and export butter, where it causes losses of considerable magnitude. It has been established quite conclusively by the work of a number of investigators that the conditions which favor its development are high acid, high salt, overworking and the presence of iron or copper salts in the butter. The results of our experiments, in which the conditions that favor the development of fishiness were studied, are entirely in accord with this conclusion.

While the conditions that favor the development of fishiness in butter are well known, the agency that causes it is still a matter of controversy; one school maintains that it is caused by biological agencies; another school maintains that it is caused by a slow spontaneous chemical change.

Even the compound that imparts the fishy flavor has not been identified beyond all dispute. Supplee and Cusick have presented evidence indicating that trimethylamine is the fishy compound and lecithin its mother substance, but this conclusion has not been generally accepted.

In our experiments the production of trimethylamine from lecithin was studied. It was found that lecithin emulsions imitating butter brine, yielded trimethylamine at room and at incubator temperatures, under conditions that exclude bacterial action. This chemical decomposition of lecithin into trimethylamine was favored by identically the same conditions that are known to favor the development of fishiness in butter.

Bact. ichthyosmius and an organism isolated from fishy cream did not produce any trimethylamine from skim milk and casein solutions, but they did produce it from lecithin emulsions in skim milk under favorable conditons. However, in the presence of salt and acid as in butter brine, these organisms failed to grow. Thus it is unlikely that bacteria will produce trimethylamine in storage butter, where in addition to the salt and acid, we have the unfavorable low temperature.

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In comparing the trimethylamine production from unhydrolyzed and hydrolyzed lecithin, it was found that the previous hydrolyzing doubled the yield of trimethylamine. Since lecithin is hydrolyzed quite readily by dilute acids, this suggests the theory that acids in butter favor the development of fishiness through the hydrolysis of the lecithin. It was further found in these experiments that salt caused a decided increase in trimethylamine in the unhydrolyzed lecithin samples, but practically no increase in the hydrolyzed samples where the choline of the lecithin was already in solution. This suggests the theory that the effect of the salt in favoring fishiness is to bring the lecithin into more complete solution so that it can undergo chemical changes more readily.

Trimethylamine lactate incorporated into butter at the rate of 100 parts per million caused a distinct fishy flavor. From the analayses found in the literature it was shown by calculation that butter of the average lecithin content can produce 66 parts of trimethylamine per million. Five samples of fishy butter analyzed for trimethylamine contained from 22 to 36 parts per million. No trimethylamine was found in normal butter.

The objection to the trimethylamine theory based upon the fact that the fishy flavor can be distilled from acidified fishy butter, was answered by demonstrating that trimethylamine sulphate and ammonium sulphate actually will be distilled from acid solutions in detectable amounts.

On the basis of the evidence presented, the conclusion is drawn that the development of fishiness in butter is due to the chemical decomposition of the lecithin in the butter, producing trimethylamine which imparts the fishy flavor. An explanation is also given of the rôle of the various factors concerned in the development of fishiness.

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Abstract No. 170.

WORLD'S DAIRY CONGRESS, 1923.

ABSTRACT.

THE INFLUENCE OF SALT ON THE FLAVOR OF BUTTER.

By A. C. DAHLBERG, New York Agricultural Experiment Station, Dairy Division, Geneva, N. Y.

The practice of incorporating some salt in butter is almost universal. Salt is a seasoning for butter; it removes the insipid taste of unsalted butter and gives a pleasing flavor that is relished by most people. If salt produced no other effects in butter than that of seasoning, the problem of the influence of salt on the flavor of butter would be comparatively simple. The indirect effects of salt on flavor, due to its influence on the composition of butter, the microorganisms, enzymes, and slow, spontaneous chemical changes, complicates the problem and makes it difficult of solution.

The problem of the influence of salt on the flavor of butter that first required attention was that of the effect of impurities in salt upon the flavor of butter. Magnesium and calcium chlorides were found to be responsible for an occasional bitter flavor in butter. Salt manufacturers, previous to 1900, learned methods of producing salt containing 98–99 per cent sodium chloride, so that this difficulty of impurities in salt has been largely removed.

The effect of salt on the flavor of butter due to its inhibition of the growth of microorganisms has been difficult to solve. Ample experimental data prove that salt, in sufficient concentration, will check or completely stop the growth of nearly all microorganisms. If the butter is not held at freezing temperatures, a few bacteria, but more especially some yeasts and molds, do grow at a reduced rate and may be the cause for off flavors developing in butter. When butter is stored at 0° F. or below, the cold temperature is the important factor in preventing the growth of microorganisms. Very meager growth of any character can be found. No correlation between the presence of microorganisms and off flavors in cold-storage butter has been made with the possible exception of *Bacterium ichthyosmius* (Hammer) and fishy flavor.

Certain chemical changes occurring in butter are markedly influenced by salt regardless of the temperature at which the butter is stored. Salt inhibits the increase in acidity, the rate of oxida-

tion, proteolysis (if any such action occurs), and enzymic activities. Whether any relationship exists between these chemical changes and the development of off flavors is very doubtful. That one chemical action, the conversion of lecithin into trimethylamine, results in fishy flavor and that this activity is accelerated by salt has been the conclusion of three separate investigators.

A low salt content (2–2.5 per cent) seems inducive to the highest quality initial flavor in butter, according to the experience of butter manufacturers of this country. The delicate, fine flavor of a high quality butter made from fresh sweet cream is hidden by excessive salt, while the flavor defects of poor butter made from old, sour, off-flavored cream are intensified by it. In storage at very low temperatures, 0° F. or below, salt has a deleterious effect on the flavor of butter, irrespective of any bacteriological or other chemical influences it may exert. All investigators do not agree with this conclusion, but the most recent work shows that unsalted butter keeps better than salted, and lightly salted butter better than that which is heavily salted. If the storage temperature is raised high enough so that microorganisms can grow, the effect of salt may be beneficial, depending upon the growth that takes place.

[62236]

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Abstract No. 171.

WORLD'S DAIRY CONGRESS, 1923.

ABSTRACT.

THE ACTION OF THE ORGANISMS PRESENT IN THE STARTERS USED IN BUTTER MAKING.

By B. W. HAMMER, Professor of Dairy Bacteriology, Iowa State College, and Chief in Dairy Bacteriology, Iowa Agricultural Experiment Station, Ames, Iowa.

During the last few years the Iowa Agricultural Experiment Station has been studying the action of the organisms present in the starters used in butter making. The results obtained show in a number of different ways that starters are not pure cultures of *S. lactis*, as was apparently at one time commonly supposed, but contain in addition to *S. lactis* at least one organism that differs greatly from it, especially in the biochemical features. Much of the work has been along the line of volatile acid production since this is easily determined and good starters show considerable and rather definite amounts of volatile acid.

S. lactis is largely responsible for the total acid development in a starter but it produces very little volatile acid. The volatile acid that is produced is acetic with propionic in rather large amounts; the organism has no action on citric acid. *S. lactis* is generally present in a starter in much larger numbers than the other organisms.

The organisms other than *S. lactis* found in starters—the associated organisms—have been divided into two types. *S. citrovorus* increases the total acidity of milk very little but forms considerable amounts of volatile acid, while *S. paracitrovorus* produces a definite but variable increase in the total acidity and, on the average, more volatile acidity than *S. citrovorus*, although there is considerable variation in the volatile acid production of different cultures. The volatile acid with both organisms comes largely from the citric acid normally present in milk.

By combining *S. lactis* with one of the associated organisms very good starters can frequently be prepared although neither organism alone is satisfactory. The lactic acid produced by *S. lactis* tends to free the volatile acids from combination with the milk constituents, may serve as a partial source of the volatile acid, and keeps down contaminating organisms, while the associated organisms produce volatile acid which is important from the standpoint of flavor and aroma development. The associated organisms also exert a restraining action on the acid development by *S. lactis*.

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Variations in the relationship between the total and volatile acidities and also in the barium and Duclaux values at different periods in the ripening of a starter show that the associated organisms develop for the most part late in the ripening period while *S. lactis* controls the fermentation during the early stages.

The addition of citric acid to milk that is to be used for starter making has not uniformly increased the volatile acid production during the period when the citric acid normally present in milk in part remains nor has it uniformly improved the flavor and aroma.

Butter, with a very satisfactory flavor and aroma, can be made from pasteurized cream inoculated with one of the associated organisms after the addition of a small amount of citric acid to the cream; this shows the importance of the associated organisms in the flavor and aroma production. The keeping quality of butter so prepared is usually very good but in some few instances considerable deterioration occurred.

The preparation of starters by mixing cultures of *S. lactis* with cultures of the associated organisms suggests the possibility of controlling the characters of a starter by the proper selection of the organisms used. It has been possible by this method to develop starters showing little tendency to the development of excessive acidities. Although such starters have usually given butter with very good keeping qualities they have not uniformly done so. The keeping quality of butter is probably so related to the character of the raw material that the type of starter is not the controlling factor in determining it. In all probability a certain character that is developed in a starter will not persist indefinitely although it may persist for a long time.

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WORLD'S DAIRY CONGRESS, 1923.

ABSTRACT.

SOME ASPECTS OF THE PHYSIOLOGY OF THE MILK GLANDS.

By Prof. H. ISAACHSEN, Roy. Agric. College of Norway, Aas, Norway. Investigations by the author in collaboration with A. LALIM, B. Agr., and I. GRANDE, B. Agr.

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1. *Effect of oestrum or heat.*—Effect on quantity of milk varying; in most cases percentage of fat increased.

2. *Stimulation of the function by manipulations.*—Heavy milking cows, 22 to 23 pounds per day, gave 1.8 pounds more milk in thrice daily milking than in twice daily; animals with 9 to 14 pounds did not react to thrice milking. Fat content unchanged. Special massage of udder during milking did not affect quantity of milk, and with very slight increase in fat content. Stimulation to "overactivity" of the milk gland by manipulation not proved, but rather in heavy milkers secretion does not reach full activity with milking twice daily; the gland is physiologically "set" for more frequent emptying.

3. *The course of the fat curve during sucking.*—Our investigations give no basis for the theory of some authors that during sucking the calf takes the fattest part of the milk.

4. *The function of the gland in intervals between milkings and during milking.*—Milk was removed twice daily in some cases, in others at one-half hour intervals in periods of 12 to 34 hours by means of milking catheter, and in two cows and one goat by continuous drawing off for 24 hours per catheter fastened to teats and discharging into rubber bag, emptied every hour. After each case the remainder of the milk was drawn off by hand milking. An essential difference was found between the secretion in the pauses and during the milking itself or in the secretion during periodic or continuous drawing off and under influence of manipulation, respectively 1 to 3 per cent and up to about 9 per cent. Thus the mechanical (nervous, chemical ?) influence upon the glands has a strong stimulating influence on the secretion. These investigations also show that during 24 hours there is a definite periodicity in secretion with a variable increase and decrease in the intensity of secretion from hour to hour. Amounts of both milk and fat and the percentage of fat fluctuate considerably, generally the maximum percentage at noon and evening. This

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periodicity explains, essentially, the difference between fat content in milk in the morning and evening when milking twice daily.

5. *Cause of the increase in fat content in milk during milking.*— Only the fat rises during milking, the content of the fat-free dry matter falls slightly in most cases; however, certain cases showed no change or a negligible rise. It does not hold true that the increase in the fat content is due to fat, in the form of cream, adhering to the gland passages. Extensive data show, in cases where a small quantity of milk was saved in incomplete milking, there was nothing in the next day's complete milking to indicate an accumulation on the fat curve. There is also a normal, greatly increased fat content in the milk which is milked immediately after the 34 hours continuous flow; in this case the cream could not be deposited in the lacteal passages, which were steadily emptied. We might partially account for this in the pressure in the udder during the intervals. Our pressure measurements (in animals giving 33 pounds of milk per day) immediately before twice-daily milkings are at least 40 to 50 centimeters on the lower edge of the udder. The microscopic picture of unmilked or slightly tapped glands show large, dilated alveoles and narrow bands of interalveolic connective tissue; epithelial cells quite full of fat drops. In completely milked glands the alveoles are smaller, bands of connective tissue broader, and epithelium free from fat drops.

A hypothetical picture of milk secretion might be thus: In interval between milkings, gland epithelium is saturated with fat; with formation of milk, fat is secreted with more difficulty than the other constituent dry substances. At this stage, factors regulating secretion of milk do not seem to determine the full activity of the gland, nor do they until the ready-formed milk is completely milked out. By degrees the regulating factors act more strongly and other factors (nervous, mechanical, thermal?) appear. Fat is now removed more and more completely, and as the formation of fat is no longer able to keep pace with the removal, the cells finally become free of fat and the milk, at the same time, reaches its maximum fat content.

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WORLD'S DAIRY CONGRESS, 1923.

ABSTRACT.

STUDIES ON THE DIMINUTION OF MILK PRODUCTION IN CATTLE.

By Dr. G. KOESTLER, Assistant, Swiss Dairy and Bacteriological Station, Liebefeld-Bern, Switzerland.

From the standpoint of milk chemistry the diminution of lactation in cattle offers an interesting subject for study. We have observed that during the period of diminution the milk becomes more concentrated, in fat content, proteins, and salts; the milk sugar diminishes but the acidity and coagulating qualities remain normal, as do also the catalase and leucocyte content. Bacterial colonies in the udder or milk glands also produce changes during this period which cause an increase in leucocytes and catalase content, a further decrease in the amount of milk sugar and a marked increase in the salt content that gives the milk a salty flavor. These tendencies increase more and more until the time when the cow is said to be "dry"; the nearer the cow approaches this state, the more closely does the milk resemble colostrum. These observations should be known to every dairyman so that he will not endanger the quality of his products by using milk possessing qualities that ofttimes are detrimental.

62807—23

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WORLD'S DAIRY CONGRESS, 1923.

ABSTRACT.

ON THE EXISTENCE OF A HITHERTO UNKNOWN DIETARY FACTOR ESSENTIAL FOR REPRODUCTION.

By HERBERT M. EVANS, Anatomist, University of California, Berkeley, Calif.

When rats are reared on a so-called "basic" ration of casein (18 per cent), cornstarch (54 per cent), lard (15 per cent), milk fat (9 per cent), and salts (4 per cent), to which daily doses of 0.4 to 0.5 gram of dried whole yeast are added, they grow normally but can not reproduce. They may exhibit normal oestrus and ovulation and conceive. The placentæ are abnormal and the products of conception are invariably resorbed. Natural foodstuffs contain a substance, X, which prevents such a sterility or cures it, once established. Green leaves, the cereals, or fresh meat will thus rather suddenly restore fertility. In some cases the favorable result was secured when the new foodstuff was added to the basic ration after ovulation and fertilization had occurred so that presumptive evidence is secured of normal germ cells but defective uterine function as the specific cause of the disease. Yet the occurrence of the disease in males shows that in this sex the germ cells are diseased and this is possibly also the case in females. There is a definite, though low, quota of the needed substance, X, in a high proportion of milk fat, for when this constitutes 24 per cent of the diet fertility may be secured. When a high proportion of commercial (unextracted) casein is used, there may also be a return of fertility, so that milk contains the needed substance in at least two of its constituents, though the amount present is usually low. The new factor is distinct from "A" since it was very low in a particular specimen of cod-liver oil of proven high "A" content (more than 10 times the potency of milk fat), and, furthermore, the dietary placental disease does not occur when the "A" quota is lower than in our basic ration, providing "X" be present. The water-soluble vitamin "B" can not be concerned since when vitamin "B" is increased by high yeast dosage or additional daily feeding of 10 c. c. of fresh milk, the disease is not affected. Vitamin "C" seems definitely eliminated by the ineffectual outcome of daily fresh orange juice dosage and by the effectual results of cereals, notoriously low in or devoid of "C." The new dietary factor "X" can be extracted by alcohol and ether from the curative foods. Studies are being conducted on the characteristics of this factor indispensable for reproduction and on its further distribution in natural foods.

62804—23

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U. S. Department of Agriculture.
Abstract No. 176.

WORLD'S DAIRY CONGRESS, 1923.

ABSTRACT.

EVIDENCE OF DEFICIENCY OF MINERAL NUTRIENTS IN THE RATIONS OF MILCH COWS.

By E. B. FORBES, Director, Institute of Animal Nutrition, State College, Pennsylvania.

Veterinarians recognize mineral deficiency of the ration as a cause of disease in cattle.

There is plausible ground for inference that lack of mineral nutrients is a factor in the cause of the nutritive depletion of the overtaxed milch cow.

The informal observations of successful practical dairymen sustain the idea that under certain conditions of soil and climate milch cows suffer, in important ways, on account of insufficiency of mineral nutriment.

There is informal evidence that, under favorable conditions as to soil and climate, but with forced feeding, as in 365-day tests of milk production, cows may suffer from mineral depletion.

The use of mineral supplements, such as bone flour, under certain unfavorable conditions of practice, is thought by many successful dairymen to be beneficial.

Under favorable conditions the milch cow normally loses calcium while she is fresh and gains calcium late in the period of lactation and while she is dry.

Extensive laboratory studies have not shown that the use of mineral supplements is beneficial, though we concede that it may be. In metabolism experiments the milch cow is peculiarly unresponsive to increase of mineral nutrients, either by change of normal feeds, or by the feeding of mineral supplements. There is a fair question, however, as to the extent to which these results of mineral balance experiments, on a laboratory basis, apply under conditions of practice.

Fresh forage is more favorable to calcium storage than is dry hay; and hay cured in cocks, under caps or covers, is more favorable than is hay cured in direct exposure to the sun.

The difference between winter roughage and fresh, green forage, then, in the light of our present incomplete understanding, seems to

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be a secondary factor in the complex which causes fresh cows on winter rations to draw on their mineral reserves for calcium, the most important causes being the exaggerated impulse of the improved cow to secrete milk and her limited ability to assimilate calcium. The ultimate cause of this limited ability to assimilate calcium has not been determined.

The results of investigation emphasize the necessity of a dry, resting period. The feeding during this time should be sufficiently liberal to permit the building up of extensive reserves of nutriment which shall protect the vitality of the cow and permit the full expression of her capacity to produce milk during the following period of lactation.

The primary opportunity for building up the nutrient reserves of the cow is during her growth as a heifer. Dairymen have debated the question as to the wisdom of liberal feeding during this period, with the preponderance of sentiment in the affirmative. The facts as to the mineral metabolism of the cow suggest the great desirability of making the most of the storage or constructive possibilities of the animal at this time.

We have found that a practical way to feed mineral nutrients to cows is to allow free access to a mixture of 1 part salt to 4 parts of bone flour. The special steam bone of the gelatine manufacturers more agreeable to handle, and more acceptable in a dairy barn, and may be safer to feed than is fertilizer bone.

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ABSTRACT.

THE RELATION BETWEEN THE QUANTITY AND AVAILABILITY OF CALCIUM IN THE RATIONS AND THE MILK YIELD OF DAIRY COWS.

By EDWARD B. MEIGS, Physiologist, Dairy Division, U. S. Department of Agriculture, Washington, D. C.

It has been shown in numerous experiments that the calcium balance is likely to be negative in milking animals, and more so, the less the quantity of calcium in the food and the larger the milk yield. Recent experiments have shown, however, that calcium assimilation is influenced not only by the quantity of calcium in the food but also by such factors as the vitamine content of the diet and exposure of the animals concerned to sunlight. It will be a matter of great difficulty to work out the quantitative effects of such factors as those on calcium assimilation, but it is nevertheless desirable that information should be obtained regarding the adequacy of various diets used in practice to meet the calcium requirements of farm animals and human beings, and regarding the physiological effects of calcium deficiencies. Experiments to determine the physiological effects on dairy cows of rations with different calcium contents, but otherwise nearly similar, have therefore been initiated at the Beltsville station of the United States Department of Agriculture, and have now been in progress for about three years.

The rations used have been of three kinds, in all three of which a grain mixture composed of maize meal, wheat bran, linseed meal, and cottonseed meal has been used. Ration A consisted of the grain mixture combined with alfalfa hay as the chief roughage; ration B, of the grain mixture combined with timothy hay; ration C was the same as ration B, except that ground limestone was added to the grain. The grain mixture used in rations B and C contained more cottonseed and linseed meal and less maize meal and wheat bran than that used in ration A in order to compensate for the low protein content of timothy hay. The three rations contained about equal proportions of protein and decidedly more than is called for by any of the feeding standards.

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It has been the plan to feed all the cows as much as they could eat without suffering from digestive attacks, and to keep detailed records of the food eaten, of the milk and fat yield, of the changes in body weights, and of the general reproductive history.

All the cows ate decidedly more than they required according to any feeding standards, and they have all shown a considerable tendency to increase in body weight during their lactation periods and to become fat under the experimental conditions. Those on rations B and C consumed a much larger surplus in total digestible nutrients above their requirements than those on ration A, but did not gain weight any faster.

The cows on ration A gave very satisfactory milk yields. Those on ration B dropped off milk yield with the progress of lactation about twice as fast as those on ration A, while the milk of those on ration C was intermediate. The feeding of ration B has interfered greatly with the processes of reproduction. The cows which received this ration were usually bred many times unsuccessfully, and often did not become pregnant either until after the ration was changed or until after they had gone dry spontaneously. Reproduction has been much more nearly normal on ration C than on ration B, and still more satisfactory on ration A than on ration C.

The results indicate that rations in which timothy hay constitutes the chief roughage are deficient for dairy cows not only in calcium but also in some other unknown material which is plentifully present in alfalfa hay.

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ABSTRACT.

THE VALUE OF MINERALS IN THE DAIRY RATION.

By Prof. OSCAR ERF, Department of Dairying, Ohio State University, Columbus, Ohio.

Numerous tests and continual observation over a period of 25 years have well established the fact that minerals are of great importance in the metabolism of the dairy cow. The chemical action of the mineral salts assists in the digestion and assimilation of the proteins, carbohydrates, fats, and crude fibers.

A cow producing only an average amount of milk requires no minerals except those in her feed unless the quality of the feed is very poor. Grains, grasses, hays, beets or beet pulp, and by-products of grain, such as bran, linseed meal, vacuum-dried distillers' grain, and peanut meal are usually high in mineral constituents of a highly digestible character.

Hays cut when quite young or just before blooming, as a rule, contain the greatest amount of minerals. Hays not properly cured lose many of their mineral salts—45 per cent of the mineral salts can be washed out of alfalfa hay by heavy rains and 25 per cent can be washed out of clover hay.

The variety of the beet has much to do with the percentage of minerals which it contains. The little red beet is higher in ash than the larger beets and is better for milk production than the sugar beet. Carrots fed in limited quantities are of benefit in supplying minerals.

As a rule concentrates are low in minerals, and owing to this, high-producing cows are not able to obtain a sufficient amount of minerals from their feed without overbalancing the other constituents. The higher the production the greater the amount of mineral salts that must be added to the ration.

Care must be taken in determining the proper minerals, the amount to be fed to each cow, and the method of feeding. Minerals should not be fed in a concentrated form but should be sprinkled over moist hays, silage, or grain feeds. Mr. Monroe, of the Ohio Agricultural Experiment Station, has found that a small quantity of lime sprinkled over the silage forms calcium lactate, which is desirable for milk production. Even the salt, to be of the greatest benefit, should be mixed with the feed.

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The following minerals have been used to the greatest extent and with the best results: Calcium phosphate, calcium carbonate, magnesium sulphate, sodium, sodium phosphate, iodide of potassium, sulphur præcipitatum, black sulphide of antimony, arsenates, iron sulphates, bromides, and sodium chloride. Bone meal and hardwood ashes have been found to give the best results of any minerals with the exception, of course, of salt. As the production increases it is often advisable to reinforce these with sulphur, potassium iodide, and other minerals.

The effect of minerals in the dairy ration is not directly evident in the increased flow of milk. The improvement in the physical condition of the animal is more apparent, and due to this the milk flow is eventually increased. Minerals also seem to have a very important effect upon the unborn calf, undoubtedly due to the improved physical condition of the mother. If judgment is used in feeding minerals, the tendency is for the calves to be strong and vigorous.

To obtain the best results, the feeder must study the individual cow, and his ability to feed and care for that cow determines to a very great extent whether she will produce nearly her maximum amount of milk over a period of years or her lifetime.

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ABSTRACT.

FACTORS INFLUENCING THE VITAMIN CONTENT OF COW'S MILK.

By R. ADAMS DUTCHER, Department of Agricultural Chemistry, Pennsylvania State College.

Lunin suggested as early as 1881 that cow's milk contains substances, other than proteins, fats, carbohydrates, and salts, which are essential for normal nutrition. Later work by Hopkins and Stepp substantiated these observations.

As soon as the vitamin hypothesis became finally established, a number of investigators turned their attention to the vitamin content of cow's milk, for it was soon recognized that an important part of the nutritive value of milk lies in the amount of vitamins A, B, and C present at the time the milk is ingested. It is now becoming quite apparent that a fourth vitamin (the antirachitic factor) must be considered in all vitamin studies.

Milk varies in vitamin content.—It was not long before investigators began to differ among themselves as to the amount of milk that would furnish a sufficient amount of the various vitamins for growth. Hopkins, for example, had maintained that 2 cubic centimeters of cow's milk contained sufficient vitamin B for the normal growth of albino rats. Osborne and Mendel were unable to get good growth unless their rats received 16 cubic centimeters of milk as the source of this vitamin. These and similar experiments made it clear that raw, pasteurized, condensed, and powdered milks all varied in vitamin potency. A number of factors that influence the vitamin content of milk have been studied. This paper will devote its attention to but three factors, i. e. (*a*) diet, (*b*) heat treatment, and (*c*) oxidation.

Diet.—Many workers had suggested the possibility that diet might influence the vitamin content of milk; McCollum and coworkers were the first to cite experimental proof in this regard. These workers used rats as their experimental animals, but it was impossible to ascertain definitely whether the lack of growth in the young rats was due to decreased milk flow or to lack of vitamin in the mother's milk.

Seasonal variation in the vitamin content of milk was noted in 1919 by Barnes and Hume and by Dutcher, Pierson, and Biester.

In 1920, Hart, Steenbock, and Ellis showed that the feeding of a vitamin-rich diet produced a milk which was much superior, in antiscorbutic potency, to milk obtained from cows fed on a dry, winter ration. During the same year Dutcher, Eckles, and coworkers and Hess, Unger, and Supplee substantiated these findings by different methods of experimentation. Later, Kennedy and Dutcher showed that the amounts of vitamins A and B in milk were also dependent upon the vitamin content of the ration. They pointed out that it was possible to produce a vitamin-rich milk in the winter by the proper choice of feeds.

Heat.—Medical men have differed among themselves regarding the heating of milk, some contending that heated milks tended to produce deficiency diseases while others did not hold this view. Recent work seems to indicate that milk may be heated to the pasteurization temperature in the absence of air with little, if any, vitamin destruction. Milk may be boiled for short periods of time with less vitamin destruction than when it is heated for long periods at lower temperatures.

Oxidation.—The work of Zilva and other investigators has shown that vitamin A is quite susceptible to oxidation, while vitamin B is apparently quite stable. Vitamin C, on the other hand, is readily destroyed by oxidation, although the ordinary methods of vat pasteurization are not considered to be very destructive, due in all probability to the slow agitation during the heating. For these reasons it has been thought that apparent superiority of milk powder made by the roller process over that made by the spray process is due to vitamin destruction in the latter by the oxidation effect of the hot air. Recent work at Washington, D. C., has shown that vitamins A and B are not destroyed by any of the drying processes, while recent work at Cornell University gives the "spray process" a "clean bill of health" by showing that the spray process does not destroy the antiscorbutic vitamin in milk, if the process is properly regulated.

It is the duty of the scientist and the dairyman to educate the public to the necessity of increased milk consumption, for milk is the most valuable single food we have. We should point out at the same time that deficiencies may occur rendering the milk less valuable than it should be. For this reason the supplemental feeding of fruit juices, cod liver oil, vegetables, etc., should be encouraged.

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ABSTRACT.

A CONTRIBUTION TO THE STUDY OF THE COMPOSITION OF MILK.

By E. HUYNEN, Professor, School of Veterinary Medicine, Gembloux, Belgium.

It would seem that the composition of milk varies little from day to day, but extensive investigations made by the author have proved the contrary to be true. The author treats this subject from the standpoint of seasonal variations and daily variations.

General seasonal variations.—Various investigators differ as to the season when the fat content of milk is greatest. Monvoisin contends the maxima occur in the spring and the minima in the fall; Eckles and Brioux discovered a minimum at the beginning of the summer and a maximum at the beginning of winter; others say the maxima occur at the end of the summer season; Kort states the maxima are found during January and February and the minima during July and August. The author's conclusions (which agree with the latter) are represented by two graphs, one showing the seasonal variations in fat and the other similar variations in the dry solids not fat.

In 1921 the maximum fat content was reached in September, October; in 1922 also in September, with a minimum in May, June, and July, which leads the author to conclude that the beginning of autumn and spring are the seasons for maxima.

The most important factor in explanation of these results is the season of calving. It was our purpose, in the herd we studied, to distribute the calves throughout the course of the year, but in spite of our efforts a good many calves were dropped at the beginning of the winter. The next year the cows were admitted to the herd after calving, thus assuring a continual introduction of "fresh" cows. This arrangement made no change in the seasonal variations.

Many think that the abundance of pasturage in the early spring and the depleted pasturage in the autumn, supplemented by the feeding of concentrated foods, explain these variations.

In 1918, 1919, 1920 the author studied a herd of 60 to 80 cattle which was fed in the winter on beets, nut cake, and hay and in the summer on a similar diet, excepting the beets for which pods and green clover were substituted. The results were the same as for cattle passing a season on good pasturage.

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Seasonal fluctuations in dry solids not fat.—This variation is analogous to that of the fat content. The maxima are attained during March, April, and May and the minima during June and July. It is evident that this variation is also affected by the time of calving.

Influence of the time and frequency of milking.—Should cows be milked twice or thrice daily? In Belgium, milking morning, noon, and night is quite common practice. The morning milking generally furnishes about 45 per cent of the daily supply, the noon milking about 25 per cent, and the evening milking about 30 per cent. The nature of the milk, and particularly the fat content, is affected by the time of milking, for example, the fat content ranges as follows: Morning, 2.8 per cent; noon, 4.0 per cent; and night, 3.5 per cent.

In Holland and parts of Belgium it has been found that, economically, the thrice-daily milking program is scarcely justifiable for the increased production compared with increased cost. In twice-daily milking the decrease in production is about 1 per cent per cow for cows giving less than 10 liters per day and 10 per cent per cow decrease for heavy milkers giving 30 liters or more per day. For a herd the total average decrease is about 6 to 7 per cent.

As to the diminution in butter-fat yield in twice-daily milking, it has been found that in some cases there is a daily decrease of from 1 to 1.5 per cent. However, the same has been found in cases of thrice-daily milking. We tried twice-daily milking at 5.30 morning and evening. The results are given in a graph. We also tried thrice-daily milking with the hope of obtaining more milk and higher quality. The results were not as we had anticipated.

As to the quantitative modifications, we found that for morning milking (thrice daily) the average during January was 2.7 of butter fat; for a twice-daily program the average was 3.4 per cent; for evening milking the average was lowered from 3.5 to 3.7 per cent butter fat (thrice-daily milking) to 3.35 to 3.4 per cent twice-daily milking.

In conclusion we would say that twice-daily milking (every 12 hours) gives an ideal milk in point of quality which is about the same for both morning and evening. The quantity of fat is appreciably the same wherever the program is used. The thrice-daily system should be used for heavy milkers whose milk is used for cheese, and it should be abandoned in cases where it is uneconomical to use on cows giving less than 12 liters daily. The feasibility of the twice or thrice daily milking program, in reality, depends upon the advantages offered in each particular situation.

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ABSTRACT.

COMPARISON OF PRESENT DAY MEASURES OF THE PRODUCTIVE VALUE OF FEEDING STUFFS AND THE NUTRITIVE REQUIREMENTS OF DOMESTIC ANIMALS.

By **NILS HANSSEN**, Department of Animal Industry, Central Agricultural Experiments Station, Stockholm, Sweden.

The measures of the productive values of different feeding stuffs evolved during the last three decades, the Scandinavian food unit, Kellner's starch value, and Armsby's therms, must all be looked upon as measures of the net energy of the feeding stuffs. They differ from one another in that the Scandinavian food units have been derived from feeding trials with milch cows, while Kellner and Armsby worked out their units from fattening oxen. The various units can be compared with one another by recalculating the effects obtained from each unit as calories.

Armsby's therms have been directly determined in this way and, correspond to a net energy value of 1,000 cal.

Kellner's starch value is equivalent to the effect of 1 kg. of starch in the fattening of ruminants. From this, an increase of fat amounting to 248 grams has been attained, which, as body fat contains 9.5 cal., means that 1 kg. starch value corresponds to 2,356 cal.

A food unit corresponds to 1 kg. of barley or 1 kg. of dry solids in roots or other feeding stuffs, with a *milk production value* of 0.75 kg. A food unit in cow's production fodder, containing at least 135 grams of digestible proteins, has been shown to produce on an average 3 kg. of milk with an average fat content up to 3.5 per cent. As milk with this fat content contains 700 cal., 1 food unit corresponds to a net energy value of 2,100 cal. in milk production, and 1 kg. milk production value to 2,800 cal.

In fodder mixtures usable in practice 1 food unit corresponds to 0.7 kg. starch value, on an average. The net energy of the food unit in fattening of ruminantia thus becomes $0.7 \times 2{,}356 = 1{,}650$ cal. The higher net energy of the food unit in milk production depends on the fact that in this case the proteins of the fodder, as well as the carbohydrates, are better utilized than in fattening.

According to investigations by Fingerling, Armsby, and others, the fully utilizable net energy of feeding stuffs seems to be of the same order in the feeding of work horses and fat pigs as in milk production.

At the same time the utilization of a certain feeding stuff, that is, its yield as net energy is not only dependent on the kind of animal and the direction taken by the production, but also upon the amount of digestible proteins, mineral substances, and vitamines in the feeding mixture, and is influenced further by the dietetic effect of the mixture, the palatability, and concentration, as well as the size of the daily ration in proportion to the normal nutritive requirements of the experimental animals. All this implies that the net energy values of the feeding stuffs are in any case not to be understood as absolute figures but as average values which give a fair expression of the relative value of a feeding stuff in a certain kind of production

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ABSTRACT.

THE COST OF PRODUCING MILK AND SOME FACTORS INFLUENCING THE COST.

By E. G. MISNER, Professor of Farm Management, Cornell University, Ithaca, N. Y.

The price received for milk is not determined by its cost of production, yet cost always enters into price in the long run because when the returns for labor in its production get too low, a decreased supply increases price.

The commonly accepted method of computing cost of milk production is to consider the charges and credits for the cow part of the dairy enterprise only. The charges may be classified as feed, including pasture, bedding, human labor, horse labor, interest on cows, depreciation on cows, use of buildings, use of equipment, bull service, and miscellaneous items. The credits may be classified as manure, calves and calf hides, milk and milk products used, and miscellaneous items. The difference equals the cow cost of milk sold.

THE COST OF MILK IN TERMS OF FEED AND LABOR.

The quantities of feed used per 100 pounds of milk produced, covering 1,214 records in 10 experiment station herds in the United States, were: Concentrates, 34.9 pounds; silage and other succulent feed, 81.6 pounds; dry forage, 50.6 pounds. The average yield of the cows was 6,565 pounds of milk and 281 pounds of fat, the average test being 4.3 per cent. The amounts of pasture and labor used were not reported for the station herds.

The quantities of feed used per 100 pounds of milk produced by 22,836 cows on 1,077 farms in eight States of the United States and one Province of Canada were: Concentrates, 28.7 pounds; succulent feed, 100.8 pounds; and dry forage, 60 pounds. The labor averaged 2.6 hours per 100 pounds of milk produced. The average yield of milk for these cows was 6,106 pounds.

Of the 1,077 farms, 506 farms with 11,890 cows reported butterfat test of milk. On these farms the average yield was 6,091 pounds of milk and 220 pounds of fat per cow, the average test being 3.61 per cent. The pounds of feed used per pound of butter fat produced on these farms were: Concentrates, 7.2; succulent feed, 25.4; dry forage, 17; and the pounds used per pound of butter fat in the experiment station herds were: Concentrates, 8.1; succulent feed, 19.1; and dry forage, 11.8.

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On 867 farms including 17,459 cows, barn feed and human labor together constituted 84.1 per cent of the net cost of production after all returns except milk were deducted from the charges.

SOME FACTORS INFLUENCING COST.

In the broader aspects the most important factors influencing milk costs are prices for the materials and effort used in production. These vary with regions and with the price level in the same region.

There are also features of the organization and operation of the business that cause variations in cost. Among these are size of business, age and size of cow, time of freshening, feeding practices, and value of offspring.

The most important respects in which a fairly large dairy results in a lower cost per unit of product are that less labor is required per animal, building charges are lower per animal, and delivery charges are less per unit of product.

Good yielding cows pay best, but increased yields are obtained at a diminishing advantage. The factors responsible for variations in yields are of more concern from the standpoint of business organization than are the yields. The size of the animal is one of the first of these. Large animals produce more abundantly and more economically. Mature cows also produce more milk at cheaper cost than young animals.

The season of year when calving occurs causes variation in yield. Under favorable conditions cows that freshen in the fall produce approximately 1,000 pounds more than cows that freshen in the spring. This results generally in lower cost per unit of product than with spring freshening.

At least two characteristics of dairy rations have an important relation to milk yields and the cost of production. One of these is the proportion of the energy derived from concentrates, succulent feed and dry forage and the other protein intake.

Cows that derive a large proportion of energy from concentrates and succulent feed, especially if winter dairies, produce more and at less cost than when a larger share of the ration is dry forage, even though the plane of energy intake be the same.

When the protein intake is large, the yield is higher and cost of production is decreased. Under ordinary farm conditions most animals do not consume sufficient protein for most profitable yields.

One of the credits made in determining net cow cost of milk production is the value of calves at birth. In grade herds calves have a low value at birth. In pure-bred herds when the animals are highly bred, the calves may have a sufficient value at birth to offset much of the cost of milk.

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ABSTRACT.

THE PRODUCTION AND UTILIZATION OF MILK.

By JOHANN FRIMML, Dairy Director, Brünn, Czechoslovakia.

In this paper the author points out the absolute necessity for milk as an indispensable food of the human race and in proof he cites the suffering occasioned in central Europe by the curtailment of the milk supply during the World War. Inasmuch as milk is consumed largely in the raw state, every precautionary measure should be taken to insure its purity. Veterinary inspection and control of herds, pasteurization, and the instruction of dairy helpers as to sanitary and hygienic methods of handling the milk, are a few of the important points discussed under the heading of production.

Under the subject of utilization, the author treats on the separation of milk, the uses of cream and skim milk, and lastly, the consumption of whole milk. For this latter use the author insists that there is no substitute, as in the case of meat and potatoes, and that for the welfare of the State an adequate supply of dairy products, and particularly consumers' milk, should be available at all times.

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WORLD'S DAIRY CONGRESS, 1923.

ABSTRACT.

THE IMPORTANCE OF THE DEVELOPMENT OF THE DAIRY INDUSTRY IN INDIA.

By WILLIAM SMITH, Imperial Dairy Expert, Kasauli, Punjab, India.

Of all the civilized countries of the world, India is probably the most backward in the development of a dairy industry. It is almost impossible to obtain reasonably pure milk at any price, and in the large cities pure milk is 100 per cent higher than it is in New York or Chicago. India imports large quantities of dried milk, milk sugar, and tinned milk foods of all sorts, which she herself should manufacture. To eliminate this dire need for dairy products will require a three-fold solution that (1) will put the cattle-breeding industry on an economic basis; (2) will insure profits for the small landholders; (3) will increase the productivity of the land.

India is dependent, almost wholly so, on the ox as a draft animal, and every agricultural operation, even to the transportation of produce, is dependent upon the strength and efficiency of the oxen. It is a current belief that good draft animals can not be produced from good milch cows and consequently, female calves are considered an economic waste. The dairy industry can not hope for a substantial foundation until the farmer is assured that he may expect a dual income from the sale of dairy products from his cows and the disposal of his oxen as draft animals. The author's experience of 18 years in India warrants his belief that a good milch cow may be used successfully to produce strong draft animals, and that, by selective breeding, such a dual-purpose cow may be developed in India.

Dairy products are practically the only animal products consumed by the people of India and there is no market for beef; therefore, if the heifers can not be kept as milk producers they are an incubus on the land and cattle breeding is discouraged because of the high cost of feeding without returns.

The conservation of the old cattle-breeding jungles as forest reserves and the increased utilization of irrigated lands which were formerly cattle jungles have been other factors contributing to the diminishing interest in dairying.

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To assist India in adequately providing for her own milk supply every small farmer must be shown the profit of keeping a few good cows. Dairying is an industry that lends itself particularly well to cooperative methods of production and marketing; and if the actual producer can reap the benefits of his labors, to the elimination of the usurer and the middleman, that fact alone will do much to restore and build up the dairy industry in India.

The Indian lands suffer from what may be classed as mixed farming and the question of how best to replenish the land with the nitrogen, potash, and phosphates removed from the soil through successive years of cultivation, is one of paramount importance. There is no doubt that the development of dairying among the cultivators would, to a large extent, settle this problem. Even though farmers persisted in burning the manure as fuel, general dairying would help to point out the greater economic advantage of using the manure as fertilizer, or at least increase the quantity available so that some portion could be restored to the land.

Aside from the agricultural aspect of the question there remains the far-reaching effect of the development of the industry on the health of the common people. Cheap and pure dairy produce is particularly essential to the health of a people whose diet is almost exclusively vegetarian, and nothing but the development of dairying as a national industry will give it to the people of India.

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ABSTRACT.

CLASSIFICATION OF THE LACTIC ACID BACTERIA.

By Prof. Dr. ORLA-JENSEN, Bio-chemical Laboratory, Polytechnic Institute Copenhagen, Denmark.

The true lactic acid bacteria ferment carbohydrates and higher alcohols to lactic acid. They only grow in the presence of proteins or complexes of amino acids and not with ammonium salts or single amino acids as the only nitrogenous nutrient. In contradistinction to most other bacteria, they are unable to liberate oxygen from hydrogen peroxide. They have no nitrate reducing power, neither do they show surface growth in stab cultures. They are gram positives, nonmotile, nonsporing rod or sphere forms, usually dividing in one plane only. According to my researches we can set up the following main groups:

(*a*) Forming only traces of by-products in addition to lactic acid:

Rod forms: Genus I. *Thermobacterium*, producing lævo or inactive lactic acid.
Genus II. *Streptobacterium*, producing dextro or inactive lactic acid.
Sphere forms: Genus III. *Streptococcus*, producing always dextro lactic acid.

(*b*) Generally forming appreciable amounts of gas and other by-products in addition to lactic acid:

Rod forms: Genus IV. *Bifidobacterium*, producing dextro lactic acid.
Genus V. *Betabacterium*, producing almost always inactive lactic acid.
Sphere forms: Genus VI. *Betacoccus*, producing generally lævo, seldom inactive lactic acid.

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U. S. Department of Agriculture.
Abstract No. 187.

WORLD'S DAIRY CONGRESS, 1923.

ABSTRACT.

THE IMPORTANT STREPTOCOCCI OF MILK AND THE RELATION OF BOVINE HEMOLYTIC TYPES TO THOSE OF HUMAN ORIGIN.

By S. HENRY AYERS, Formerly of the Research Laboratories, Dairy Division, U. S. Department of Agriculture.

Streptococci from some of the important sources of contamination of milk have been studied and traced through the souring period. The typical streptococcus of the udder is *Streptococcus mastiditis*. *Streptococcus bovis* is the typical streptococcus of cow feces, while that of the back of the mouth of cows is variety B. *of Streptococcus bovis*.

TABLE 1.—*Characteristics of Streptococci from different sources.*

Source and total number cultures.	Number cultures.	Hemolysis.	Ph in fermentations.							CO^2 from—		NH_3 from peptone.	Sodium hippurate hydrolysed.		
			Dextrose.	Lactose.	Saccharose.	Salicin.	Mannite.	Raffinose.	Inulin.	Peptone.	Dextrose.				
Udder, 100	64	Beta	4.5+	4.5+	4.5+	7.3 or 4.5	7.3−	7.3−	7.3−	+	−	+	+	Var. Beta.	Streptococcus mastiditis.
	15	Gamma, some green.	4.5	4.5	4.5	7.2 or 4.5	7.2	7.2	7.2	+	−	+	+	Var. Gamma.	
Feces of cow, 78.	54	Usually show a slight hemolytic zone about colony not clear of blood corpuscles.	4.5	4.5	4.5	4.5	7.5	4.5	7.5	−	−	−	−	Var. A.	Streptococcus bovis.
	21		4.5	4.5	4.5	4.5	7.5	4.5	4.5	−	−	−	−	Var. B.	
Mouth of cow, 80.	69	do	4.6	4.6	4.6	4.6	7.0	4.6	4.6	−	−	−	−	Streptococcus bovis var. B.	
Human, mostly pathologic conditions, 32.	23	Beta	5.4+	5.4+	5.4+	5.5+	7.4−	7.4−	7.4−	+	−	+	−	Streptococcus pyogenes.	
	9	do	5.4	5.4	5.4	5.5	5.5	7.4	7.4	+	−	+	−	Streptococcus infrequens.	

TABE 2.—*Per cent of different Streptococci found in souring milk.*

	Per cent acidity as lactic acid.		
	.18-.25	.30-.49	.60+
Streptococcus lactis	27.7	59.0	92.3
Streptococcus kefir	67.4	41.0	6.7
Miscellaneous streptococci	4.9	0	0

These streptococci probably always contaminate milk, but have not been found in souring milk. It appears that they are easily overgrown. As milk sours, *Streptococcus kefir* predominates in milk of low acidity and *Streptococcus lactis* in milk of high acidity. Neither of these streptococci have been found in the udder, feces, or back mouth of cows. *Streptococcus mastiditis*, the bovine hemolytic streptococcus, is very frequently found in the udders of apparently normal cows and so is frequently present in milk, but there appears to be no reason to believe that it is pathogenic for man when consumed in milk. It can be readily differentiated from the human hemolytic streptococcus which is pathogenic.

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WORLD'S DAIRY CONGRESS, 1923.

ABSTRACT.

LACTIC ACID BACTERIA, WITH SPECIAL REFERENCE TO THE BACILLUS ACIDOPHILUS TYPE.

By LEO F. RETTGER, Laboratory of General Bacteriology, Yale University, New Haven, Conn.

The group of gram-positive rod-shaped organisms, frequently referred to as aciduric, has in recent years acquired considerable importance. This group is made up of the following three general types: *Bacillus bulgaricus*, *Bacillus acidophilus*, and *Bacillus bifidus*. Of these three, *Bacillus acidophilus*, in particular, has received very much attention within the last five years.

Bacillus acidophilus closely resembles *Bacillus bulgaricus*, and in many ways, also, *Bacillus bifidus*. It differs, however, from *Bacillus bulgaricus* in one very important respect. It is primarily, and perhaps wholly, an intestinal organism, whereas *Bacillus bulgaricus* is an ordinary saprophyte and can not adapt itself to the human or animal host as *Bacillus acidophilus* is now so well known to do. *Bacillus bifidus* also is an intestinal organism, but the requirements for successful experimental implantation of this organism are much more exacting than those of *Bacillus acidophilus*. For these reasons *Bacillus acidophilus* is the organism par excellence which is most appropriate for therapeutic purposes along lines originally indicated by Metchnikoff.

Bacillus acidophilus may be readily implanted and maintained in the intestinal tract of man and lower animals by the administration of definite amounts of lactose or dextrin. The same results may be obtained by the use of pure cultures of *Bacillus acidophilus*, particularly acidophilus milk.

Acidophilus milk, when properly prepared, is especially appropriate as an agent involving the acidophilus principle—that is, for curative and therapeutic purposes in connection with intestinal and related ailments.

Because of its smooth, creamy character, and pleasant odor and taste, it should also establish itself as a valuable beverage. The chief obstacles lie in the difficulty of preparation. However, these difficulties have been successfully overcome by the use of proper facilities,

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including a careful and able operator, and by close supervision of a trained bacteriologist.

Unless these proper facilities are available, attempts to produce satisfactory acidophilus milk will certainly result in failure. The manufacture of this product should be limited to those who are able and prepared to undertake it, since unsuccessful production of the milk—that is, an acidophilus milk which has "off" tastes and odors due to contaminating bacteria, will of necessity prejudice the consumer against the product and do the acidophilus principle irreparable harm.

The successful commercial production of acidophilus milk on a large scale as a beverage and therapeutic agent will be of practical significance to the dairy industry. It should establish an outlet for skim milk and dessicated milk, the economic disposal of which has always been, and still is, a very serious problem. That a satisfactory uniform acidophilus milk can be produced commercially has been already thoroughly established. The widespread use of lactose for regulating bacterial conditions in the intestinal tract also has an important bearing on dairying. Lactose is one of the most valuable foods for man, and anything that will bring it into prominence as a food alone, like ordinary table sugar, or as a therapeutic agent, can not but be of value to those who are financially interested in the production of milk and other dairy products.

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WORLD'S DAIRY CONGRESS, 1923.

ABSTRACT.

THE CHEMISTRY OF CASEIN.

By L. L. VAN SLYKE, Chief in Research, Division of Chemistry, New York State Experiment Station, Geneva, N. Y.

Of the proteins contained in cow's milk, casein is the one of most importance in respect both to its relative quantity and to its commercial relations.

Amount.—About 80 per cent of the proteins in milk is casein. The percentage varies with conditions, going as high as 4.50 per cent of the whole milk or as low as 1.60 per cent. In normal market milk the amount is usually between 2 and 3 per cent.

Commercial importance is due to: (1) Its high food value, (2) its fundamental relation to the cheese industry, and (3) the increasing multiplicity of useful applications, as evidenced by numerous patents.

Method of preparation.—Crude commercial casein is prepared from skim-milk or buttermilk by natural souring or by treatment with HCl or H_2SO_4, resulting in a coagulum that is washed with water and dried. The purest casein is prepared thus: Freshly separated skim-milk (unheated and undiluted) is mixed with an acid of normal concentration (preferably HCl or mixture of HCl and acetic), the acid is added slowly and the milk is kept in brisk agitation by special stirrer. When near the isoelectric point the mixture is allowed to stand three or more hours, under gentle agitation, to complete the reaction, after which more acid is added until the isoelectric (4.6 to 4.7 P_H) is reached. The casein is separated by centrifuge and washed several times by centrifuging with water. It is then centrifuged with strong alcohol and finally with ether. The last traces of remaining salts are removed by electrolysis.

Composition.—Casein is very complex in molecular composition or structure, belonging to the general class of proteins and the subdivision of phospho-proteins. The products of its catalysis thus far isolated number about 20. Of the various suggestions made in regard to the form in which casein exists in milk, the weight of evidence at present indicates that it is in combination with calcium as a salt, calcium caseinate.

Action of acids.—Acids, added to milk in sufficient amount, combine with the calcium of calcium caseinate, forming uncombined

casein. This absorbs appreciable amounts of dilute acids, without being dissolved. Casein is dissolved in more concentrated acids, resulting, according to conditions, in combinations of acid with casein or in decomposition products of casein.

Action of bases.—Casein combines with the bases of alkalis and alkali carbonates to form caseinates easily soluble in water. Bases of alkaline earth form compounds with casein, which vary in solubility. Compounds of other bases with casein have been studied to a limited extent. The number of different compounds casein can form with a base can not, as yet, be regarded as definitely known. A summary of the evidence now available presents two points of view: (1) Casein may form one to four different compounds with calcium; (2) casein may form one, and perhaps two, definite compounds with calcium, the other so-called compounds being mixtures of calcium caseinate with casein, or there may be an infinite number of so-called colloidal compounds containing less base.

Action of salts.—In milk saturated with certain salts, calcium caseinate is precipitated at ordinary temperatures. Calcium chloride and some other salts precipitate calcium caseinate in milk heated to 35° to 45° C. Some insoluble compounds of casein are soluble in warm 5 per cent solutions of Na Cl.

Action of heat.—Salts of casein are changed in properties when heated under pressure at 130° to 140° C.

Action of solutions of formaldehyde.—Formaldehyde combines with casein to form a compound insoluble or difficultly soluble in acids. The basicity is decreased and the acidity increased. The reaction can be used as the basis of a method to estimate casein quantitatively.

Action of rennet extract.—Rennet extract precipitates calcium caseinate as calcium paracaseinate, the action taking place probably in three stages: (1) Change of calcium caseinate into paracaseinate, (2) change of insoluble calcium salts of the milk into soluble salts, and (3) precipitation of calcium paracaseinate by the soluble calcium salts.

Methods of estimating casein.—Of numerous methods employed in making quantitative estimation of casein in milk, the following are commonly used: (1) Precipitation with acids (preferably acetic) or with alum, and determination of nitrogen in washed precipitate; (2) direct volumetric estimation (*a*) by neutralization with alkali followed by precipitation with standardized acetic acid and subsequent titration of filtrate with standardized alkali, or (*b*) treatment with solution of formaldehyde; (3) determination of the refractive index of casein in the form of soluble salt.

[62313]

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ABSTRACT.

THE CHEMISTRY OF MILK AND DAIRY PRODUCTS VIEWED FROM A COLLOIDAL STANDPOINT.

By LEROY S. PALMER, Professor of Agricultural Biochemistry, University of Minnesota, and Dairy Chemist, Minnesota Agricultural Experiment Station, University Farm, St. Paul, Minn.

Many of the important phenomena in dairy chemistry are colloidal. The structure of milk shows a microscopic dispersion of fat stabilized by a colloidal dispersion of proteins and dicalcium phosphate. The principal proteins present are casein and lactalbumin. The dispersion of casein is that of certain of its calcium compounds, while that of the lactalbumin appears to be the base free protein. The factors which determine the stability of the colloidal calcium caseinates, lactalbumin, and dicalcium phosphate have not been thoroughly studied, nor is it clear what the interrelations are between the stability of these three colloids. The problem is of considerable technical importance in the operations which employ high or low temperatures, both of which affect the stability of colloidal dispersions.

The secretion of milk is a colloidal phenomenon, involving inhibition of water by colloids, production of a stable fat emulsion, and the colloidal dispersion of proteins and mineral salt.

The variations in the creaming of milk, particularly standardized market milk, are closely related to the mount and properties of the hydrophilic colloids present, and the effect of the practical operations of pumping, freezing, pasteurization, and the like in these properties.

Studies made by the writer show that the detrimental effects of pasteurization are concerned with the casein compounds of the milk.

All the ordinary factors causing coagulation of milk—namely, heat, acid, and rennin—are factors affecting the stability of the colloidal state of the casein, lactalbumin, and dicalcium phosphate present in the milk. The rennin coagulation is especially interesting but is not a purely colloidal phenomenon involving a stabilizing colloid, as some have believed, because colloidal dispersions of calcium caseinate undergo the same changes under suitable conditions.

In the whipping of cream the colloids perform the double function of stabilizing the oil-in-water cream emulsion and also the air-in-water

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foam emulsion produced by the whipping. Most of the variations in the whipping quality of cream are due to this double rôle played by the cream colloids.

The chief colloid problems in ice cream manufacture at present have to do with the study of the fundamental factors which give ice cream mixes the property of imparting to the finished product the desired overrun, body, and texture. These problems have scarcely been touched.

The production of butter from cream is a phenomenon involving the inversion of an oil-in-water to a water-in-oil emulsion. The writer's study of this inversion indicates that the actual inversion is gradual and is completed some time before the butter "comes." Ca-Na ratios do not appear to affect this inversion as in the case of simple emulsions. An interesting illustration of the relation between the orientation of molecules in surface films and the water-covering capacity of fats is seen in the fact that a rise in the water content of butter follows an increase in the oleic acid content of the butter fat. The microscopic dispersion of fat in butter is also related to its keeping quality.

Aside from the rennin coagulation, the ripening of cheese, particularly of the Cheddar type, presents many interesting colloidal problems involving chemical changes in a colloidal gel structure.

The stability of the colliodal casein compounds of milk presents the most important colloidal problem in the evaporated-milk industry. The same problem is presented in the manufacture of dried milk, which must also retain a mximum ease of wetting for the redispersion of its colloidal constituents as well as undergo a minimum deterioration in storage.

The use of casein in the arts and industries, such as in the manufacture of glues, paints, and plastics, involve the colloidal properties of casein compounds. The fundamental colloidal problems involved have been given very little study.

[62359]

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ABSTRACT.

ON THE PRESENCE OF LECITHIN IN MILK AND IN THE UDDER.

By OSAKAR LAXA, Prague, Czechoslovakia.

The author wishes to draw attention to the study of phosphatids in the udder which probably play an important rôle in the formation of milk and milk fat.

From the observations made, it is evident that the udder is richer in materials of phosphatid nature than the milk. The materials of cephaline character are predominantly phosphatid; substances of lecithin nature are shown to exist in much smaller quantities.

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Abstract No. 192.

WORLD'S DAIRY CONGRESS, 1923.

ABSTRACT.

THE STANDARDIZATION OF DAIRY EQUIPMENT.

By J. GILLARD STAPLETON, Representative British Dairy Farmers' Association, Owles Hall, Enfield, England.

The author urges the need for standardization of dairy equipment, pointing out that the creamery proprietors and all those responsible for handling milk should, first of all, determine the standard equipment necessary to secure efficiency and economy, and then insist upon its adoption. If this were done, producers and manufacturers would have to come into line. The difficulties in the way are referred to. The paper then goes on to deal with the various processes involved in the milk trade, from the time when the milk is drawn from the cows until it reaches the glass bottle. In the milk room, for example, the need for the adoption and general use of a standard milk bucket is mentioned. Certain points which should be introduced into such a milk bucket are referred to. The milk should then be transferred promptly to the cooling room, and passed through a recognized standard strainer. The writer then speaks of milk in transit, dealing with the need for standardization of the railway milk churn, and of the transport lorry. Cream separators also require standardization in many directions. Coolers are already becoming standardized. The need for a standardized method of pasteurizing is dealt with. A standard weighing machine is required to obviate the risk of disputes between the buyer and seller as to the quantity of milk dispatched.

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ABSTRACT.

STANDARDIZATION.

By S. J. VAN KUREN, Factory Sales Manager, J. G. Cherry Co., Cedar Rapids, Iowa.

A brief treatment of the subject entitled "Standardization" was prompted in the mind of the author by a recognition of many errors that have occurred in the development of America's dairy industry as a result of an evident weakness on the part of manufacturers of dairy machinery, utensils, and supplies to meet the views and theories bordering, perhaps, on eccentricity, and to humor what might be termed the whims of the trade. This has resulted in a multiplicity of variations in design, type, size, and style in all lines of dairy supplies and machinery.

The same thing has also developed to a great extent among manufacturers and distributors of dairy products, and has likewise resulted in a great increase in the sizes and styles of market packages, thereby creating a demand for a great deal of unnecessary duplication.

It is the purpose of this paper to draw attention to the economic waste brought about by lack of standardization in all lines of dairy development, and progress, represented by a great increase in investment, raw materials, patterns, tools, equipment, stocks of finished parts and assemblies, completed mechines, manufacturing overhead costs, delay in delivery, increased manufacturing cost, etc., all of which culminates in an unnecessary burden upon the ultimate consumer.

In this article, reference is made to similar conditions existing in other industries, some of which have come into the public prominence through investigations carried on by the United States Chamber of Commerce; and the successful efforts of certain divisions and committees appointed by the chamber of commerce to assist the manufacturers in reducing a great many of the unnecessary sizes, styles, and designs, all of which has proven of great benefit to manufacturer, distributor, and consumer.

A further object of this article is clearly a desire on the part of its author to warn other countries or districts, where the dairy industry may be still in its infancy, against the development of a similar situation, as well as to start the mental machinery of great minds in our own country to work upon the problem of bringing about economic improvement through cooperation and coordinated effort along the lines of universal standardization.

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Abstract No. 194.

WORLD'S DAIRY CONGRESS, 1923.

ABSTRACT.

BENEFITS OF PRINCIPLE OF STANDARDIZATION.

By WILLIAM A. DURGIN and RAY M. HUDSON, Division of Simplified Practice, Department of Commerce, Washington, D. C.

In this paper the author has endeavored to point out the commercial and the economic benefits accruing from the application of the principle of standardization. He first explains "standardization" and cites the conditions which have made its application essential to the development and maintenance of industrial and commercial stability. Then the author supports his statements with numerous facts drawn from an engineering survey of "Waste in Industry." Next comes a summary of the reasons why dairymen the world over may well be interested in standardization. Not only is it essential from their position as producers that they seek to eliminate the wastes resulting from the lack of greater standardization in their industry, but it is in their power as distributors and consumers to lower costs to themselves, and to the public generally, by encouraging more uniform practices, and widening the field of application of existing standards.

Emphasis is given to the service rendered by the United States Departments of Agriculture and of Commerce in promoting the wider adoption and use of existing standards and also in developing standards of dimension, size, quality, and nomenclature in fields where such criteria do not now exist. Reference is also made to the work of the standardization of equipment committee organized at the international convention in October, 1920.

A summary of the benefits of standardization is given as follows:

"Standards in articles of commerce reduce the enormous cost of taking commodities from the manufacturer to consumer—

"By promoting easy and complete understanding between buyer and seller as to dimensions, weight, quality, and performance of the commodities in question.

"By reducing the waste accruing from the manufacture and distribution of goods of inferior or unusable quality.

"By reducing the waste in accounting, storage, packing, etc., of unnecessary variety of sizes, weights, qualities, etc.

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"By reducing the legal costs necessitated by lack of common understanding."

Widely accepted standards mean a reduction of human thought and effort required in supplying the most common human wants, thus releasing a large sum total of human thought and energy, toward the development of new arts and sciences, social betterment, and the improvement of standards generally.

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WORLD'S DAIRY CONGRESS, 1923.

ABSTRACT.

SELECTION OF METALS FOR DAIRY EQUIPMENT.

By O. F. HUNZIKER, Blue Valley Creamery Co., Chicago, Ill.

This study, concerning the suitability of different metals for dairy equipment, suggests the following deductions:

1. All the base metals now in use in the construction of dairy equipment are more or less soluble in lactic-acid solutions, and their lactates have a bitter, puckery, astringent, metallic taste. This solubility is greatest in the case of zinc, iron, and aluminum, but the intensity of the metallic flavor per unit metallic lactate is greatest in the case of copper and alloys containing copper, and least in the case of tin, zinc, iron, and nickel.

2. Equipment in which large surfaces of bare iron, copper, and metallic alloys, such as bronze, German silver, white metal, monel metal, milk metal, etc., are exposed to milk, cream, and other milk products, is prone to give to the milk product an objectionable metallic taste.

3. The presence in milk and milk products of iron, copper, and metallic alloys or their salts induces or accelerates deterioration of the dairy product. The exact nature of this accelerated spoilage is as yet not well understood, but the results suggest catalytic action as at least a contributory cause. In some instances the nature of the spoilage points to bacterial activity, the presence of the metals, their salts, and their oxides exerting a selective action on certain species of bacteria.

4. Metallic alloys, such as German silver, white metal, monel metal, etc., have been found unsuitable also because of their tendency to become pitted. The possibility that most of these alloys may lack homogeneousness of structure suggests that their immersion in milk or other fluid-milk product induces electrolytic action. It is quite probable, therefore, that electrolysis may be responsible, in part at least, for both their accelerated corrosion and pitting and for their injurious action on the dairy product.

5. Tin and nickel appear to be the only metals under observation that produce no detrimental effect on the quality of the milk products in commercial handling and manufacture. The proper tinning of metals and alloys that have been found to be injurious to milk prod-

ucts, such as iron, copper, and the metallic alloys, diminishes the detrimental effect and may render their use harmless; but the coat of tin must be heavy and must cover all the surfaces of the metals that are in contact with one another and that are immersed in the milk product, otherwise electrolysis may largely forfeit the benefits of the protective action of the tin coating. Nickel plating has proved unsatisfactory on account of early and rapid peeling off of the nickel coating. Solid nickel equipment has so far produced no harmful effect on milk. Its introduction, however, is of too recent date to warrant final conclusions.

6. Aluminum has been found serviceable for milking pails and other utensils and equipment of limited size. Its use for these purposes appears to have no injurious effect on milk. Its comparatively low resistance to humid air, impure water, weak alkalies, acids, and brine, and its tendency to pit, however, detract from its suitability for large dairy equipment, but the application of aluminum for such equipment has been too limited to fully demonstrate its behavior and its effect on the milk product.

7. Glass enameled steel, such as is now used for dairy equipment, has no metallic action on dairy products. It is not attacked by air, is insoluble in water and in weak acids, such as are contained in sweet and sour milk and cream and other milk products, and in weak alkalies, such as are in general use in the form of washing powders in milk-products plants. The enamel is nonporous and, when properly fused in sufficient thickness on high-grade steel, it prevents contact of the milk product with the steel. It does not form lactates nor give the milk product metallic flavor, and it is inert from the standpoint of electrolysis and catalysis. Its low thermal conductivity, however, renders glass enameled steel unsuitable for equipment intended for rapid heating and rapid cooling, such as flash pasteurizers and flash coolers. It may be used for batch heating and cooling of limited volumes, but where large volumes of dairy products must be handled, it is best suited for tanks in which the cooling is completed and for holding purposes.

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WORLD'S DAIRY CONGRESS, 1923.

ABSTRACT.

MILK AND METALS.

By Dr. RICHARD SELIGMAN, The Aluminum Plant and Vessel Company, Limited, Wadsworth, London, S. W.

With the disappearance of the wooden tubs and pails of our forefathers the milk industry has emerged into a period of higher sanitation, entailing the use of metal vessels and plant equipment.

The interaction of milk and the various metals at different temperatures and pressures becomes very important and authoritative information is highly desirable.

This paper covers the scattered references available, adds some results of original research, and attempts to mark out the field of work which should be covered.

Excluding the metals and alloys obviously dangerous or unsuitable, the remainder are placed in their probable order of toxicity, and their possible effect on flavor considered.

Investigations of the effect of milk on metals is extremely difficult owing to the complex mixture of bodies in that liquid, and experimenters have generally confined their attention to the amount dissolved from unit surfaces of the metals, by milk, without attempting to determine what are the corrosive and what the protective bodies of the milk. Similarly, much work is still to be done in determining the results when two metals are exposed in contact with one another to the action of milk, as curious anomalies arise. Apart from the laboratory, the cleanliness or otherwise of the milk plant has much to do with whatever action is set up.

The wide use of aluminum in European as opposed to United States dairies is noted.

Experimental work and references in connection with this metal disprove some of the work published in the United States, which showed a solubility utterly at variance with the results of research and standard European practice, and note is made of the effect of the addition of silicate of soda in rendering harmless the use of soda as a cleansing solution.

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Nickel, when pure, is an admirable metal for dairy work, but the difficulties of jointing are at present extreme. Alloys of nickel and copper (monel metal) have proved disappointing.

A great future is anticipated for chrome or rustless steels when methods of uniform manufacture have arrived and when suitable jointing methods have been discovered.

The field of investigation is a wide one and many workers are required to cover it adequately. The effort is made to define the most necessary work and to bring about some more coordinated method of experiment and publication of results, than has hitherto been the case.

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U. S. Department of Agriculture.
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WORLD'S DAIRY CONGRESS, 1923.

ABSTRACT.

CONSTRUCTION OF CONTINUOUS-FLOW HOLDERS USED IN PASTEURIZATION, ESPECIALLY IN REGARD TO THE TIME FACTOR, FROM A BACTERIOLOGIST'S VIEWPOINT.

By C. S. LEETE, Market Milk Specialist, Dairy Division, U. S. Department of Agriculture, Washington, D. C.

Proper pasteurization of milk means the holding of every particle of milk at a temperature of 145° F. for 30 minutes. Exposure at this time and temperature will kill pathogenic bacteria and allow a margin of safety. Apparatus used for pasteurization should be so constructed as to make certain that the requirements of pasteurization are completely carried out. The bacteriologist views pasteurization primarily from a public-health standpoint.

Continuous-flow holders are so constructed as to allow a continuous flow of milk through the machine from the inlet to the cooler. A series of tanks, pipes, baffle plates, and various distributers and collectors have been employed in this type of apparatus, the object in each case being to govern the rate of flow of milk to such a degree that the time for any particle of milk to pass through the apparatus will be that required by pasteurization regulations.

The holding time of the holder can not be determined by ordinary means of observation. Various tests using colors (dyes), chemicals, and changes in temperature have been made with varying results. In each case certain criticism has been made regarding the tests' lack of sensitiveness and accuracy.

Recently the Department of Agriculture has devised a test which, it is believed, is very accurate, sensitive, and practical when used for determining the holding time of continuous-flow holders. The test is made essentially the same as when a color or chemical test is run, excepting that a water emulsion of a 24-hour-old bacterial culture (*B. prodigiosus*) is used in the place of a dye or chemical. In brief, the method of making the test is as follows: The entire system is

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filled with tap water. (It is essential that there is a sufficient supply to run the system at its rated capacity for at least 30 minutes.) The pump is started and run at such a speed as to deliver at the outlet the rated quantity. No heat is used. Frequent checks upon the rate of flow are made. Samples of the incoming and outgoing water are made. These are check samples. These check samples and all other samples are for bacteriological analysis and so must be taken aseptically into sterile containers. While running at the rated capacity a water emulsion of a 24-hour culture of *B. prodigiosus* is introduced at the inlet of the holder, the time being noted. Samples are then taken at the outlet of the holder. The more frequently the sampling is done, the more accurate the test will be. Samples should be taken at least every three minutes up to 18 minutes, and every minute thereafter. The machine should be run at least one-half hour and samples taken during that time.

Samples are then plated on agar, 1 c. c. of the sample being used direct, and incubated at room temperature (20° C.) for 48 hours. At the end of the incubation period the plates are examined. As the test organism has a very characteristic growth (deep red color) the time of holding can readily be determined, provided the check samples are negative.

Results of studies made with this type of machine, both under actual commercial conditions and in the laboratory, point to the fact that careful qualitative bacteriological analysis of milk pasteurized by this method should be made. In many instances the actual flow through the machine does not coincide with the theroetical flow.

From the viewpoint of a bacteriologist pasteurization means not only a low count milk but a safe milk. A temperature of 145° F. for 30 minutes is essential for safety. Manufacture and use of continuous-flow holders should be based on actual bacterial tests rather than on estimates and theoretical flow.

With other types of holders, especially those having numerous valves and cams, where there is a chance of leakage or the holding time is apt to be shortened by any means whatsoever, this test will prove of value.

[62261]

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Abstract No. 198.

WORLD'S DAIRY CONGRESS, 1923.

ABSTRACT.

HOLDING TANKS FOR THE MILK PASTEURIZING PROCESS.

By SAMUEL M. HEULINGS, New York City.

The object of the pasteurization of milk is the destruction of any disease-producing microorganisms the milk may contain. The Department of Agriculture of the United States, the British Ministry of Health, and many scientists of unquestionable authority, define the process of the pasteurization of milk as having the three following elements:

1. Heating to not below 145° F.
2. Holding at not below 145° F. for not less than 30 minutes.
3. Cooling to 50° or below, promptly after the holding period.

The second element, holding, requires that all of the milk treated by the process must be held at not below this temperature for a period of not less than this time. To accomplish this requires the application of mechanical construction that has not been utilized in many of the alleged pasteurizers now in use; that is, many of the contrivances said to be pasteurizers, on account of inefficient construction, have no means of holding up the temperature of the first milk that enters the holding tank or tanks; have no means of maintaining the holding tanks at the pasteurizing temperature during a shutdown of the apparatus while in course of plant operation; have no means of maintaining the temperature of all the milk and the temperature of the foam during the holding period.

Also, on account of inefficient construction, many pasteurizers do not prevent an oversupply of milk to the holding tank; do not prevent short-circuiting, seepage, and infection of the treated milk; do not prevent bacterial diffusion from causing an inoculation of the treated milk; do not record on charts the temperature of all of the milk held; do not record on charts the shortest period of time to which all of the milk must, absolutely, have been subjected; giving opportunity for the impairment of the pasteurizing process, by unscrupulous parties, without the knowledge of the health authorities.

Any alleged pasteurizing apparatus that does not embody in its construction means for the maintenance of all the milk at the pasteur-

izing temperature for the holding period, or is so constructed as to not, absolutely, prevent the infection of the treated milk, is dangerous to public health and its use should be prohibited by law.

There is no reason, whatever, for any of the above-mentioned omissions in the manufacture of holding tanks, and, furthermore, there should be a suitable time-recording device on the holding tank to provide a fairly dependable means for health authorities to check up the observance of the law regarding pasteurized or certified milk.

[62204]

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U. S. Department of Agriculture.
Abstract No. 199.

WORLD'S DAIRY CONGRESS, 1923.

ABSTRACT.

MACHINE MILKING IN NEW ZEALAND.

By A. B. ROBERTSON, Auckland, New Zealand.

The first milking-machine trial was made in New Zealand about 30 years ago. Following that, several makes of machines were imported but none was successful in milking the cows clean enough and with the labor of milking the cows by hand after finishing with the milker, there was little advantage over the old hand methods. In 1900 a Scotch machine was introduced, which, although it was not entirely satisfactory, paved the way for later improvements and helped to break down the prejudice among the dairymen who had insisted on adhering to the old methods.

After various milkers had been introduced with some changes in type and number of buckets, a dairy farmer in the Taranaki district designed the releaser plant which eliminated the use of buckets and conveyed the milk direct from the cow to the receiving tank. This meant a great saving of labor but it was not an unqualified success. In comparison with the bucket plants the releaser system had two drawbacks—it did not milk the cows as clean nor was it cleansed as easily as the old system. These drawbacks have since been overcome, and now the entire system, pipes and all, can be taken down and washed thoroughly. The releaser system so popularized the milking machine in New Zealand that at the present time about 20 different makes are in use in some 12,000 plants and supply about half the milk of the Dominion.

All milking machines are operated on the same principle, a vacuum being created by a vacuum pump driven either by water wheel, electricity, or oil engine. The principal differences in the various makes of machines lies in the pulsators and cups. Some pulsators are automatically driven and others mechanically; on account of their greater reliability, the mechanical pulsators are more popular. The latest improvement in mechanically driven pulsators is the feature which makes the pulsator adjustable to each cow. The principle of the cups is the same for all makes, a rubber inflation within a metal case and with metal or rubber mouthpieces. The latter are more

generally used, as they do not fall off and their softness and flexibility tend to greater comfort for the cow.

The advent of the milking machine demanded a special type of milking shed and what is now known as the "walk through" shed has been found the best suited to the needs of the average dairy. The stalls are ranged on both sides of the alleyway and each stall is 7 feet wide divided into two equal sections to accommodate two cows. The cow is held by a chain or rope around the hindquarters, and when she has been milked and stripped by hand a door is opened at the head of her stall and she is turned out so that another cow may take her place without delay. This shed permits the handling of a maximum number of cows with a minimum of time and labor. Each set of cups milks, on an average, 10 cows per hour—that is to say, a 4-cow plant will milk 40 cows per hour with two attendants.

With proper care of the equipment, it has been demonstrated that machine milking is more sanitary than hand milking and also much cheaper. The comparative costs of milking 80 cows with a machine and three helpers, and without a machine but with six helpers, cost respectively, £367 11s. and £576. With three hand milkers taking twice the time, or four hours, the cost for the nine months' period was £288. Nine months is considered the milking season in New Zealand.

It is doubtful if the dairying industry would ever have acquired its present-day magnitude and prestige in New Zealand if milking machines had not come into use, and one of the chief reasons for its success may be accredited to the close supervision of the dairy division of the Department of Agriculture in connection with the sanitary construction and cleansing of the machines.

The extent and increase in machine milking in New Zealand is shown by statistics of the number of milking plants, as follows: 1919, 7,577 plants; 1920, 8,806 plants; 1921, 10,450 plants; 1922, 12,465 plants.

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Abstract No. 200.

WORLD'S DAIRY CONGRESS, 1923.

ABSTRACT.

ON KEEPING QUALITY OF SWEETENED CONDENSED MILK.

By ATSUSHI MIYAWAKI, B. S., M. S., Nogakuhakushi, Professor of Dairy and Meat Technology, Hokkaido, Imperial University, Sapporo, Japan.

There are many problems to be solved in the art and science of manufacturing sweetened condensed milk. Comparative newness of the industry, however, drew but a little attention of "lactologists." The industry is gaining an important position among dairy products. More attention should, therefore, be given to this product.

Of many problems, the question of keeping quality is most important. Deterioration of foodstuffs is generally attributed to bacterial fermentation. So, deterioration of sweetened condensed milk is also attributed to this cause. A study on bacterial flora of sweetened condensed milk, however, shows that the deterioration is not necessarily due to bacterial fermentation. The number of bacteria in canned condensed milk can not be the criterion for judging the keeping quality. Moreover, the number of bacteria decreases in most cases on incubation at 38° C.

Investigations were made with samples taken from over fourteen hundred batches of sweetened condensed milk made by the author under factory conditions. The results of the investigation show that all condensed milk thickens or becomes "pasty" sooner or later, on ageing, regardless of bacteria in it. This thickening is merely physical in nature. There is no sure method of foretelling the keeping quality of a condensed milk at the time of manufacture. Incubation method is fairly useful in forecasting the future of a condensed milk. The results of experiments show that a condensed milk which thickens within three weeks in incubator, will not keep under natural conditions for any more than six months. That which is to keep well for years under natural conditions should keep well in incubator for more than nine weeks. A high heat method may be substituted for incubation in order to obtain the results within one or two hours. This latter method is, however, much more uncertain.

Butter fat has a property of keeping fluid consistency of sweetened condensed milk, while casein tends to set. A condensed milk made from milk poor in fat thickens much quicker than one made from

milk rich in fat. In order to manufacture condensed milk which is to keep well for years, it is necessary to select milk testing more than 3 per cent in fat. It is unnecessary, however, that the percentage of fat in milk for condensing is any higher that 3.5 per cent. Of condensed milk made from milk testing lower than 3 per cent, only 12.71 per cent kept well for more than two years, while 75.65 per cent of condensed milk made from milk testing higher than 3 per cent kept well for more than two years.

Sucrose is the preservative of sweetened condensed milk. Without this sugar, condensed milk will not keep more than a few days, unless otherwise preserved. To successfully check the bacterial fermentation in condensed milk, it is necessary to use more than 12 per cent sugar by weight of fresh milk. Besides checking the bacterial growth the sucrose has a property of improving the consistency of condensed product. Therefore, the rate of sugar added has an influence on keeping the fluid consistency. To insure a good keeping quality, it is necessary to use more than 15 per cent sugar by weight of fresh milk.

A high vacuum has a good influence on the keeping quality. It is wise, therefore, to maintain the vacuum higher than 26 inches in the pan. The rapidity with which a unit amount of milk is condensed is very important. The condensing should be accomplished at a rate less than 25 minutes per 1,000 pounds of fresh milk.

[62388]

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U. S. Department of Agriculture.
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WORLD'S DAIRY CONGRESS.

ABSTRACT.

THE HEAT COAGULATION OF MILK.

By H. H. SOMMER, Ph. D., Assistant Professor of Dairy Husbandry, College of Agriculture, University of Wisconsin, Madison, Wis.

In the sterilization process in the manufacture of evaporated milk, the milk frequently coagulates so readily that it is difficult or impossible to give it a safe sterilizing process without causing curdiness. This trouble is most prevalent during the winter months and usually disappears suddenly when the cows go on pasture in spring.

In the study of this problem the factors involved in the heat coagulation of fresh milk were first determined by studying their coagulation at 136° C. The knowledge gained in this way was then applied to the evaporated milk.

Since sodium bicarbonate is used quite extensively in the industry in an attempt to remedy this trouble, the first factor that was studied was the acidity. In the study of a number of samples of fresh milk from individual cows the titratable acidity varied from 0.10 to 0.26 per cent lactic acid, and the pH from 6.25 to 6.97, but there was no consistent relation between either of these two values and the coagulation.

The concentration of the milk was found to a be a factor, but it did not account for the wide differences in the coagulation found in the milk samples.

It was found that the calcium and magnesium and the citrates and phosphates in the milk have a pronounced effect upon the coagulation. There is a balance between the effect of the calcium and magnesium and the effect of the citrates and phosphates; an excess of either of these two classes of salts causes coagulation; a proper balance produces the most stable condition. The amounts necessary to produce an effect are equivalent to less than 0.01 per cent CaO. Because of the wide variations in the salt composition of milk, and because such small variations in the milk salts have such a pronounced effect upon the coagulation, the conclusion is that the main factor in the heat coagulation of fresh milk is the composition and balance of the milk salts.

The effect of the milk salts was then studied on evaporated milk, both on a laboratory and a commercial scale. It was found that

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their action is exactly the same as in the fresh milk. In all the cases of troublesome heat coagulation studied on a commercial scale, no case has been found where it was due to an excess of citrates and phosphates. In all cases it seems to have been due largely to an excess of calcium. Additions of sodium citrate or di-sodium phosphate produced a decided improvement in such cases. The amount of di-sodium phosphate added varied from 4 to 10 ounces per thousand pounds of evaporated milk. Even where 16 ounces are used, this amounts to an increase of only 0.0099 per cent P_2O_5 on the basis of the uncondensed milk. The use of di-sodium phosphate as a remedy for this trouble has already been adopted quite extensively in the industry.

The addition of 0.09 per cent lact-albumin to a sample of fresh milk caused a distinct increase in the coagulation of the condensed milk made from it. The conclusion is that the albumin content may be an important factor in the coagulation.

It is known that low preheating temperature increases the coagulation. In a comparison of preheating at 180° F. and at the boiling point, the lower temperature produced milk that had a higher soluble albumin content, and that coagulated much more readily than the milk preheated at the boiling point. The explanation is offered that the effect of high preheating temperatures is due to a decrease in the soluble albumin content, and in addition, to a precipitation of soluble calcium salts.

Sodium bicarbonate has a slight balancing effect against an excess of calcium, and as a result its beneficial effect in many cases is due to this effect and not to neutralization of acidity. In mild cases of unbalanced salts the sodium bicarbonate may remedy the difficulty, but in more severe cases the use of sodium citrate or di-sodium phosphate is more effective.

In the ripening of milk the citric acid is rapidly destroyed, and where there is only a slight increase in acidity the pronounced effect on the coagulation is due mainly to this decrease in citric acid content, and not to the minute change in acidity.

The greater prevalence of this trouble during the winter months is explained on the basis of the lower citric acid content in the milk produced on dry feed, the excess of calcium in the milk at the end of the lactation period, and the higher albumin content in milk produced in the first and the last stages of the lactation period.

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ABSTRACT.

FACTORS INFLUENCING THE HEAT COAGULATION OF MILK, AND THE THICKENING OF CONDENSED MILK.

By ALAN LEIGHTON, Physical Chemist, and E. F. DEYSHER, Dairy Chemist, Dairy Division, Bureau of Animal Industry, U. S. Department of Agriculture, Washington, D. C.

This paper, while discussing several factors which influence the coagulation of milk by heat, gives particular attention to the effect of temperature and time of forewarming upon the stability toward heat of evaporated and condensed milks.

Considerable evidence is presented to show that the mechanism of the reaction which causes the thickening of condensed milks at ordinary temperatures is the same as that of the curdling of milk when it is subjected to high temperatures. An endothermic chemical reaction is shown to accompany the heat coagulation reaction. This heat absorption evidently comes from the precipitation of some of the calcium and magnesium of the milk. For the work in this paper the comparative stability of evaporated and condensed milks toward heat has been determined by roughly determining the magnitude of this heat absorption. The milks were placed in a small autoclave which was then immersed in a constant-temperature oil bath at a temperature of 130° C., a temperature sufficiently high to cause rapid curdling. The temperature of the milk was measured by means of a thermocouple after nine minutes, an arbitrary time. Since the greater the stability of the milk, the higher the temperature attained in this time, we have a very convenient method for getting the information we wish.

The results obtained in this way were checked, in the case of evaporated milks, by determining the relative time required to produce coagulation in the regular pilot sterilizer and in the condensed milks by determining the time at which thickening took place when they were stored at 50° C., a sort of accelerated storage test.

The evaporated and condensed milks were all made from skim milk obtained at the United States Department of Agriculture farm at Beltsville, Md. The condensed milks had a concentration of 48 per cent sucrose, 20 per cent milk-solids-not-fat, and 32 per cent water.

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In order that there might be a direct relation between the condensed and evaporated milks, the latter were made up with 36.4 per cent milk-solids-not-fat to 61.6 of water, the same ratio of milk solids to water as were present in the condensed milks.

The data obtained by determining the stability of both evaporated and condensed milks which had been forewarmed at different temperatures (65, 75, 85, 95, 100, 110, and 120 degrees) for different times (0, 5, 10, 15, 20, 25, 30, and 60 minutes) is plotted in two ways. When we plot stability against time of forewarming, we obtain a series of constant temperature curves. The most prominent feature of these curves is that each seems to lie in its own particular zone. This indicates that the temperature of forewarming is a most important factor, while the time of forewarming is less significant, since the curves for the most part slope but little.

If, however, we are to plot the temperature of forewarming against stability, we obtain curves which show more clearly the effects of forewarming temperatures. We see at once that in the case of condensed milks a 65° C. forewarming slightly stabilizes the finished product over the unforewarmed material. At 75° C. there is slight increase also, while at 85° C. a decrease sets in which is a very marked at 95° C. An increased stability follows upon forewarming at 110° and 120°.

The curves for evaporated milks are practically the reverse of those for the condensed milks. The 65° C. forewarmed material is slightly less stable than the unforewarmed product. Stability then increases up through a 95° C. forewarming, where it is near a maximum, and decreases at 110° and 120°.

The difference between the evaporated and condensed milks is shown in all probability to be due to the reaction between the cane sugar and the calcium and magnesium of the milk.

Other data is given which seems to point very strongly to the fact that the effect of forewarming itself upon the stability of milks toward heat is its effect upon the salt equilibrium.

Some aspects of the effect of forewarming upon the salt equilibrium are discussed from the point of view of experiments in osmotic pressure, electrical conductivity and freezing point measurements made for the most part upon forewarmed unconcentrated milks.

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ABSTRACT.

THE KEEPING QUALITY OF DRY MILK.

By G. C. SUPPLEE, Director, Research Department, the Dry Milk Co., 15 Park Row, New York.

Dry milk develops a characteristic stale condition during storage, the casein becomes less soluble and the color darkens. The presence of moisture in the product is largely responsible for the development of these defects. The ability of the casein to retain its original suspendability in water after a given storage period depends upon the moisture content of the powder during the period it is held. Milk powder rapidly absorbs moisture from the atmosphere; and unless properly protected its moisture content may increase to as high as 11 per cent in normal humidities. Excessive moisture originally contained in the powder, or that absorbed, may render the casein totally incapable of normal suspension within a few weeks. Skimmed-milk powders and those containing fat are subject to the same types of deterioration induced by excessive moisture.

Rancidity and tallowiness are characteristic defects of milk powder containing any appreciable amount of fat. Rancidity develops more frequently in powders made by the spray methods, whereas this defect is rarely found in powders made by the Just process, tallowiness being the predominating storage defect in such powders.

Experimental evidence taken in conjunction with the known facts regarding the temperatures used in dehydrating by these methods points toward active enzymic material as a possible factor in the development of rancidity.

Tallowiness, which is common to all milk powders containing fat, is primarily due to oxidation. Observations on commercial and experimental powders made by the Just process show that several factors which enhance oxidation accelerate the development of tallowiness. Low storage temperatures were found to prevent its manifestation in partially skimmed-milk powder for over 18 months, whereas at normal room temperatures the defect was evident after 5 to 7 months.

Copper, in the form of organic salts or that taken up by the liquid milk in contact with the metal during storage or heating, was found to cause the development of tallowiness in milk powder much sooner

than when the product contained none of this metal. Copper contained in the liquid milk at the rate of 10 to 15 parts per million caused the appearance of tallowiness in the powder after 50 days; when contained at the rate of 1 part per million as dissolved from the metal, strong tallowiness directly attributable to its presence appeared after 9 to 10 months, whereas the product not so contaminated remained in good condition after 12 months.

Iron and iron salts studied in parallel with copper were found to be less effective in their catalytic action; an earlier development of tallowiness, however, than in uncontaminated samples was directly attributable to the presence of this metal.

It was found that the greater the oxygen concentration of the gas enveloping milk powder during storage, the more rapidly did tallowiness develop. In oxygen concentrations of 2½ per cent tallowiness was manifested after 11 to 14 months. It is questionable whether methods now available for excluding oxygen from the powder will successfully preserve it for indefinite periods.

Other things being equal, powders made by the Just process keep longer as their fat content is increased. It was found that powder containing 5 to 6 per cent fat kept satisfactorily for only 3 to 4 months at room temperature; that containing 12 to 13 per cent fat kept for 6 to 7 months; that containing 26 to 27 per cent fat usually kept for 10 to 13 months; and that containing 50 to 55 per cent fat kept well for 15 to 18 months.

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U. S. Department of Agriculture.
Abstract No. 204.

WORLD'S DAIRY CONGRESS, 1923.

ABSTRACT.

THE KEEPING QUALITY OF BUTTERFAT, WITH ESPECIAL REFERENCE TO MILK POWDER.

By GEORGE E. HOLM and GEORGE R. GREENBANK, Chemists, Dairy Division, U. S. Department of Agriculture, Washington, D. C.

The two changes that commonly occur in milk powder held in storage are tallowiness and fishiness. The latter change occurs only when the moisture content of a powder is high and above the figure usually found in manufactured powders. The real problem is therefore concerned with tallowiness.

While this change is determined to a large extent by exterior conditions (temperature of storage, humidity, etc.), the tendency of a butterfat to become tallowy is largely dependent upon the state of the butterfat itself.

The conditions governing the production of tallowiness have been studied and it has been found that this state may be produced by an auto-oxidation or by exposure of a butterfat to light in the absence of free oxygen. In the presence of oxygen with the aid of light or metals as catalysts the condition is produced very rapidly.

The intensity of the Kreis test is a quantitative measure of the degree of oxidation but is not a quantitative measure of the degree of tallowiness. The compounds responsible for the Kreis test are not identical with those causing tallowiness. Tallowiness is undoubtedly caused by mixtures of heptylic aldehyde, pelargonic acid and other by-products of oxidation of oleic acid and other unsaturated acids. These compounds (heptylic acid and pelargonic acid) do not produce a Kreis test.

Oxygen absorption may, therefore, be followed very accurately by means of the Kreis reaction and has been used to determine the degree of oxidation of butterfats.

All butterfats show a period of induction when exposed to oxygen (a period when no oxygen is absorbed). This period varies in length according to the age and quality of the butterfat used. Fresh butterfat at a temperature of 95° C. requires a period of three hours before oxidation begins, while an old fat requires less time.

In the presence of water vapor this oxidation proceeds less rapidly and the period of induction is increased. In the case of milk powder

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the same effect has been noted. Absolutely dry powder seems to become tallowy sooner than a powder with a low moisture content.

Two powders having different vapor pressures for the same moisture content will show minimum tendency to oxidation—not at the same moisture content but at the same vapor pressure.

Too high moisture causes fishiness.

As milk powder ages, its vapor pressure increases and if the moisture content is near the upper limit for keeping quaility it may become fishy because of increased free moisture or increased vapor pressure.

Pure butterfat will become tallowy in the absence of free oxygen, especially if acted upon by light. Samples of milk powder sealed in vacuo and stored without access to light have become tallowy.

Storage in atmosphere of CO_2 or N_2 will not prevent the formation of tallowiness in butterfat or milk powder.

The latent conditions existing in butterfat which make possible the production of tallowiness in vacuo have been studied.

Methods have been devised for removing this latent condition. Heating the butterfat in the presence of water (or steam distillation) up to a certain point, or the thorough washing of a butterfat, will produce a fat with a keeping quality far superior to the fresh fat. Heating alone does not seem to be as efficient a method to accomplish the change.

The results have been applied to milk-powder manufacture.

[62199]

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U. S. Department of Agriculture.
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WORLD'S DAIRY CONGRESS, 1923.

ABSTRACT.

THE ATTAINMENT OF BACTERIAL PURITY IN THE MANUFACTURE OF DRIED MILK.

By R. F. HUNWICKE, B. Sc. (Lond.), A. I. C., H. JEPHCOTT, M. Sc. (Lond.), F. I. C., and N. RATCLIFFE, F. I. C.

The bacterial content of milk powder should be very low, but this can not be attained without the most meticulous care at every stage of manufacture.

Since control of milk supplies is common to all milk factories, this paper is only concerned with the post-drying period in factories manufacturing standardized dried milk by the roller process in New Zealand.

Bacterial control extending over three years has been successful in reducing the bacterial count on the bulk product to negligible proportions before shipment to England: over 90 per cent of samples during November, 1922, showed a count of less than 50 per cc., while 6 per cent were completely sterile.

Opportunities for contamination occur in the final packing process in England, in which the powder is resifted and packed in small containers for the retail trade. In order to keep a check on this, bacteriological control was instituted. Twelve months of this control have witnessed a reduction of the average agar count of the finished product by 75 per cent.

The extent of contamination during packing was tested both by taking out the average figures on a long series of samples before and after packing, and also by direct experiment on the same sample of powder.

The technique employed in the examination of dried milks is identical with that used in the examination of ordinary wet milks, except that much larger quantities are taken for each test. It is never necessary to dilute good-quality reconstituted dried milk before plating.

Microscopic examination of the centrifugalized deposit from reconstituted dried milk is not found to give results in accordance with the plate count. So few organisms are seen at any time in the centrifugalized deposit that it appears probable that the majority are either destroyed or rendered unstainable in the drying.

This is not in accordance with the conclusions of Supplee & Ashbaugh, who consider that 50 per cent of the number of bacteria in the original milk are stained in films of the reconstituted milk made by Breed's method.

Investigation of the number and nature of living bacteria in the final product is regarded as the best criterion of bacterial purity, and the only means of checking recontamination during manufacture.

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U. S. Department of Agriculture.
Abstract No. 206.

WORLD'S DAIRY CONGRESS, 1923.

ABSTRACT.

FAT IN COMMERCIAL CASEIN.

By H. JEPHCOTT, M. Sc. (Lond.), F. I. C., and N. RATCLIFFE, F. I. C.

In view of the commercial objections to casein containing a high proportion of fat, various factors influencing the fat content of casein are considered.

Careful observation has been made of the preparation of rennet casein curd at a number of factories, and samples of the separated milk, whey, wash water, and curd examined as to their respective fat contents. It is shown that in normal cases from 44 per cent to 64 per cent of the fat in the separated milk remained in the casein.

Any tendency for the curd to cheddar resulted in larger proportion of the fat being retained by the curd.

Laboratory experiment also showed that if the curd were cut whilst still very tender, the casein contained less fat than if the curd were allowed to become very firm before cutting.

A critical comparison of the various suggested methods for the determination of fat in casein has been made, and it is demonstrated that the Werner-Schmidt method alone is reliable for all varieties of casein.

The Rose-Gottlieb method gives fairly satisfactory results with acid caseins, but is useless for rennet caseins.

Soxhlet extraction and the method recommended by Gangolli and Meldrum fail to extract more than a small proportion of the fat in the casein and, consequently, give fallacious results.

In carrying out the Werner-Schmidt method of fat determination, appreciable errors may be introduced unless care is taken in cooling and handling the fat flask.

The fat should always be reextracted from the flask with petroleum ether, and the difference in weights taken as fat.

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U. S. Department of Agriculture.
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ABSTRACT.

ADMINISTRATION OF MILK CONTROL.

By WILLIAM H. PRICE, M. D., Sanitarian, Detroit Creamery Co., Detroit, Mich.

To be successful, an attempt at milk control must deal squarely with three fundamentals of milk supplies in their relation to human service, namely:

1. Abundant supplies of milk must be maintained.
2. They must be adequately safeguarded.
3. They must be available at reasonable price, as low as is consistent with maintenance of abundant supplies and adequate safeguarding.

The first essential of successful administration is a workable program; the second is a competent personnel; the third is concentration on the ultimate goal, with elimination of superfluous procedure.

Official milk control is attempted for the purpose of establishing and maintaining reasonable standards of food value, safety, and cleanliness in milk, of stimulating the demand for it, and of creating fair conditions of competition amongst producers and dealers. Producers and dealers control the supply factor in any market, and consumers the demand factor. Official milk control should run parallel with these economic factors.

Technical training is desirable in milk-control officials; but industry, integrity, good sense, and rational enthusiasm are indispensable qualities.

The program must confrom to the requirements, possibilities, and limitations of the particular community.

A reasonable, practical, and operative ordinance is necessary for successful milk control.

Control of fraud is essential and is in the interest of the dairy industry as well as of milk consumers.

Holding pasteurization is the only adequate safeguard for milk supplies. Holding pasteurization means heating milk to a temperature of approximately 145° F., never lower than 142° F., holding at that temperature for a period of 30 minutes and then cooling below 50° F. The use of a tested thermograph is imperative. Protection against subsequent infection is necessary. This method of safeguarding is effective and practical.

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Scoring, medical inspection, tuberculin testing, low bacterial counts, and grading based on these have been suggested as alternatives for holding pasteurization; but they are regarded as ineffective safeguards.

City milk plant inspection is essential to insure efficient pasteurization. Dairy-farm inspection, with use of the score card of the National Dairy Division, is desirable in the interest of prompt cooling, sterilized utensils, small-top pails, and general sanitation. Medical inspection on dairy farms is impractical as a routine procedure. Only 1 per cent of human deaths from tuberculosis are due to the bovine type of infection, and these are better eliminated by holding pasteurization than by tuberculin testing. Bacterial counts may furnish valuable indexes regarding cleanliness of production and handling, age, and cooling of milk, and efficiency of pastuerizing equipment and methods; but bacterial counts do not safeguard nor indicate safety; they require frequent checking to eliminate sources of error, and they are without value unless interpreted with knowledge of the dairy industry. Grading is sometimes advocated as a primary measure in milk control; but if more than two grades are provided for, the system becomes confusing and difficult of enforcement.

Reliable publicity is desirable; but publicity is not *administration.* A demonstration of actual safeguarding will prove more constructive.

A workable program having been adopted and a competent personnel employed, active administration of milk control consists largely of:

1. Protecting first-class dairymen against unfair competition from the careless, the ignorant, and the dishonest.

2. Enlightening the ignorant and careless and converting them into the first class.

3. Eliminating the dishonest and persistently noncooperative from the milk business.

This administration is best conducted through the medium of the annual, revocable license system.

[62283]

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U. S. Department of Agriculture.
Abstract No. 208.

WORLD'S DAIRY CONGRESS, 1923.

ABSTRACT.

MILK ADMINISTRATION IN ENGLAND AND WALES.

By J. N. BECKETT, Principal, and J. M. HAMILL, Esq., O. B. E., M. D., D. Sc., Medical Officer, Foods Department, English Ministry of Health, London.

The work of milk administration is carried out by local authorities acting through their medical officer of health and his staff. The authorities act in accordance with the provisions of acts of parliament and of regulations and orders of the ministry of health. The ministry of health does not take part in the actual administration, but either alone or in conjunction with the ministry of agriculture and fisheries undertakes the initiation of legislation and the issue of regulations and orders. It also exercises considerable influence over the action of local authorities by the issue of circulars and memoranda and by giving advice and guidance as required.

The law for the prevention of adulteration is mainly contained in the sale of food and drugs acts, and is administered by authorities acting for somewhat large areas (mostly counties and county boroughs). The enforcement of these acts is carried out by means of the purchase of samples and their submission to the local public analyst for examination. There is no legal standard of composition for milk, but regulations made by the predecessors of the ministry of agriculture and fisheries have the effect of providing that where the composition falls below certain prescribed limits (3 per cent of fat and 8.5 per cent of other solids) the onus of proving that the milk has not been adulterated rests on the defense. The milk and dairies (amendment) act, 1922, contains an absolute prohibition against the addition of coloring matter, water, skimmed or separated milk or recon-

stituted milk to milk intended for sale and it is an offense to sell such a mixture even though it is not described as milk. Regulations of the ministry of health prohibit the addition of any preservative substance to milk.

The administration of the law relating to the cleanliness and hygienic condition of milk is mostly in the hands of local authorities for the smaller areas (known as sanitary districts). Orders made by the predecessors of the ministry of health require these authorities to keep registers of all dairymen; and a retailer may be struck off the register if the local authority considers it necessary in the interests of public health. The orders in question require the proper lighting, ventilation, cleansing, drainage and water supply of dairies and cowsheds and prescribe precautions against the infection and contamination of milk.

A scheme for the grading of milk on the basis of its hygienic condition has recently been adopted. The scheme is of a voluntary nature and provides for the issue of licenses for the sale of milk under the prescribed special designations. The licensee is required to pay a small fee to cover the cost of the bacteriological examinations necessary for the administration of the scheme. The special designations which have been adopted are "certified," "Grade A (tuberculin tested)," "Grade A," "Grade A (pasteurized)," and "pasteurized." The tuberculin test is required for the first two grades only. For Grade A milk there is a veterinary examination of the herd. The term "pasteurized" is limited to milk which has been treated by the "holder" process. Bacteriological standards are laid down for all grades.

[62813]

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U. S. Department of Agriculture.
Abstract No. 209.

WORLD'S DAIRY CONGRESS, 1923.

ABSTRACT.

PRESENT POSITION OF MILK ADMINISTRATION IN SCOTLAND.

By GERALD LEIGHTON, O. B. E., M. D., F. R. S. E., Medical Officer (Foods), Scottish Board of Health, and ARCHIBALD STALKER, Public Health Departmment, Scottish Board of Health.

General note; recent Scottish legislation; general tendency of Scottish administration; the law and regulations governing the sale of dairy produce in Scotland; administrative bodies; the Scottish board of health; town councils; county councils; district committees; the Scottish board of agriculture; administrative staff; medical officer of health; sanitary inspector; veterinary surgeon; public analyst; sampling officer; the control of disease; the dairies, cow sheds and milk shops orders; the milk and dairies (amendment) act, 1922; the sale of milk under the sale of food and drugs acts; legal proceedings and penalties; grading of milk in four grades; powers of Government departments; recommendations of the recent interdepartmental committee on the sale of milk in Scotland.

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U. S. Department of Agriculture.
Abstract No. 210.

WORLD'S DAIRY CONGRESS, 1923.

ABSTRACT.

THE EXTENT TO WHICH BACTERIOLOGY CAN BE UTILIZED ADMINISTRATIVELY TO IMPROVE THE MILK SUPPLY.

By Dr. W. G. SAVAGE, M. D., B. Sc., County Medical Officer of Health for Somersetshire, England.

For the determination of pathogenic bacilli nothing can replace the bacteriological method. It is the most reliable method of detecting tuberculosis in individual cows and also in showing whether tubercle bacilli are present in the milk. It is less valuable for other pathogenic organisms.

Bacteriology is essential to judge the efficiency of pasteurization. Definite bacteriological standards have been set up by the Ministry of Health for pasteurized and graded milk. There are no other standards that can replace bacteriology for grading milk.

Fixed bacteriological standards, while they are theoretically admirable, are not practical administratively. They are too sensitive and liable to variation from factors which are not readily controlled. More important is the fact that they may not penalize the worst offenders, since a fixed standard magnifies disproportionately the influence of time and temperature. Maximum conditions of time and temperature have to be allowed, which means a limited standard. The only way to prevent this is to have separate standards for milk at the cow sheds and as vended and to vary the latter in summer and winter.

Bacteriology finds its greatest utility when used in conjunction with general methods of supervision over the milk supply. It is superior to inspection methods because milk inspectors can not always or, indeed, more than occasionally, be present at milking times, while in this country many of them are not well grounded in the relative importance of the different factors. Clean milking is best judged by its results and this can only be done bacteriologically. Bacteriological examinations do pick out with tolerable uniformity the milk vendors and others whose methods of handling milk are below a reasonable standard. It enables the worst offenders to be recognized and improved or weeded out. The examination of chance samples is of very little use. To arrive at a helpful opinion we must

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know for each sample the conditions of time and temperature since milking. Separate working standards for cow sheds and vended milk must be utilized. Their use is quite practicable. For example, the inspector can collect large numbers of samples as the milk arrives at the milk depots, and the bacteriological results can be speedily arrived at.

The usual standard adopted is one of the number of bacteria per c. c. This standard has conspicuous limitations and is far inferior to a *B. coli* standard both theoretically and on practical grounds. The determination of the latter is not affected by laboratory divergencies, can be quickly carried out, and the results recorded without trouble.

Bacteriological methods used on these lines and in conjunction with inspection, form the cheapest way to control the purity of the milk supply.

[62391]

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U. S. Department of Agriculture.
Abstract No. 211.

WORLD'S DAIRY CONGRESS, 1923.

ABSTRACT.

THE SUPPLY OF MILK TO LARGE TOWNS.

By Prof. Dr. ORLA-JENSEN, Biochemical Laboratory, Polytechnic Institute, Copenhagen, Denmark.

Three conditions are necessary for the production of really good drinking milk, i. e., milk which is palatable and can be given to children without having first to boil it:

1. Veterinary control of the cows, and medical control of the staff taking care of the milk. In this way, most of the most dangerous pathogenic germs and toxins are excluded.

2. Payment according to quality, based not only on the fat content but also on the fermentation and reductase test, thus insuring a palatable product of good keeping qualities and one in which there are relatively few fecal bacteria, as well as one treated in such a way that the pathogenic bacteria, which will unavoidably be found even in the best milk, have not been able to increase.

3. Low temperature pasteurization, by which the keeping powers of the milk are further enhanced without the milk being appreciably affected chemically, and by which such harmful bacteria, as may be present in the milk in spite of the two foregoing conclusions, are killed.

62809—23

WASHINGTON : GOVERNMENT PRINTING OFFICE : 1923

U. S. Department of Agriculture.
Abstract No. 212.

WORLD'S DAIRY CONGRESS, 1923.

ABSTRACT.

THE HYGIENIC AND ECONOMIC CONTROL OF MARKET MILK PRODUCTION IN NEW YORK STATE.

ROBERT S. BREED, Chief in Research, New York Agricultural Experiment Station, Geneva, N. Y.

New York State, with its large city population and important agricultural resources, is naturally the leading State in the Union in the production of milk for consumption in fluid form. Under these conditions it is natural that the study of milk control problems in the State developed many ideas useful in this field—as, for example, the dairy score card.

While the thought in the mind of Dr. R. A. Pearson, one of the originators of these cards, was that they should be used as an educational force to stimulate the dairymen to secure better equipment and to use better methods, the score was quickly seized upon as an index of the quality of the milk produced. The idea that there was a close relationship between the dairy score and the quality of the milk produced became so firmly established that it was a shock to many interested in milk control work when it became apparent that high class, clean milk was frequently produced under very primitive conditions and that fine equipment is no guaranty that high class, clean milk will be produced.

Coincident with this use and misuse of dairy score cards, there has been a development of simple analytical methods for use in determining the quality of milk—as, for example, the Babcock test for fat.

The development of laboratory control by means of bateriological counts has been handicapped by the cost of establishing laboratories and the difficulty of securing an adequately trained personnel. For these reasons, New York State workers have been especially active in so simplifying routine analytical procedures that a large number of samples could be handled at a small cost. Thus the New York City laboratory has been active in simplifying the composition and cost of the agar medium. Dr. C. E. North has been an advocate of the simplification of the plating procedure and Dr. M. C. Schroeder developed the sediment test, so that larger numbers of samples could be handled quickly. The author of the present paper has also developed a method for the microscopic examination of milk for determin-

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ing the numbers and types of bacteria in milk. All of these procedures have been incorporated from time to time in the Standard Methods of Milk Analysis drawn up by the laboratory section of the American Public Health Association.[1]

The larger milk companies have also established control laboratories of their own whose function it is to maintain the composition and sanitary quality of the product that they handle so that it shall meet the standards fixed by regulation.

New York City was also the pioneer in the grading of milk into the classes commonly designated as Grades A, B, or C, raw or pasteurized milk. This grading system became mandatory in the State in 1913.[2] The foundation of this grading system has been the development of suitable laboratory methods and facilities. While the dairy score card was at first a large element in this system of classifying the milk, it is no longer used in the City Code, and has been practically eliminated from use in the State Code. The grading is largely based on the quality of the milk itself.

With the shift in emphasis from a dairy control which dictates the type of dairy construction, methods, and the like, that shall be used by the dairyman, to one that permits him to follow the system best suited to his own needs, provided only, that he produces a high-class product, some of the distrust of the dairyman for the good sense and even honesty of the dairy inspection is passing away. At the same time the dairymen and milk dealers have learned to value the grading of their product which permits high-quality goods to secure proper recognition in the city markets. Unfortunately, there still remain certain foolish regulations in many places which do not permit the dairyman to use his own native talent in producing high-grade milk cheaply. When he is allowed to do so, the cost of production will be lessened, thereby benefiting both the producer and the consumer.

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[1] 370 Seventh Avenue, New York City. Cost, $0.40.

[2] See the New York City and the New York State Sanitary Codes.

[62253]

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U. S. Department of Agriculture.
Abstract No. 213.

WORLD'S DAIRY CONGRESS, 1923.

ABSTRACT.

MILK SERVICE IN CITIES.

By G. J. BLINK, Secretary of the Union for Dairy Industry and Milk Health-Science, The Hague, Holland.

The consumer can only judge to a very limited extent of the quality of the milk.

This fact often results in unfair competition between milk of inferior and milk of good quality.

This unfair competition often prevents improvement.

A solution for this problem can only be found with some sort of legal assistance of the authorities.

The interference of the authorities must, however, be restricted to the necessary minimum.

A plan for a solution is given.

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U. S. Department of Agriculture.
Abstract No. 214.

WORLD'S DAIRY CONGRESS, 1923.

ABSTRACT.

THE NECESSITY FOR LEGISLATIVE CONTROL IN THE SALE OF MILK BREADS.

By R. M. ALLEN, Director, Research Products Department, Ward Baking Company, New York City.

Now that we have found that whole milk can turn whole wheat into a balanced food, state and federal regulation should require a standard for milk breads or require the amount of milk to be stated where milk is claimed.

This can be done in two ways: (*a*) By specific statutes, and (*b*) by regulation under general and existing statutes. The first question is to determine the amount of milk to be required before a loaf may be called "milk bread." The second question is what descriptive terminology shall be allowed when skimmed milk solids are used.

In 1906 an arrangement was made whereby the committee on food definitions and standards, appointed by the Association of State Dairy and Food Departments, and the one appointed from the Department of Agriculture, the Association of Official Agricultural Chemists, were combined into one committee of nine. This committee promulgated in 1922 a standard for milk bread requiring that at least one-third of the liquid content shall be whole milk. It will be recognized that this was a low standard, but it was also felt that if this standard could be put into effective operation it would pick up a large amount of whole milk solids, and that the standard could be increased with the movement for standardization of milk bread once in motion.

In the event it is possible for the dairy and baking industries to reach an agreement on this with the government officials and based on the results from nutritional studies, the amount of milk contained in the loaf in order to be sold as milk bread can be written into Federal and State statutes. Where a standard has been arrived at as a perfect finality it is far easier of enforcement when written into statute. But if the amount of milk can not be agreed upon, then the United States Department of Agriculture and the States should be given more specific authority for adoption of standards giving the amount of

milk to be contained in milk bread. The dairy industry because of experience in litigation over standards and the change of standards with changing administrations will prefer the statutory standard. If such a standard is formulated and written in the statutes, the industry should see that it is uniform throughout the States, since bread is entering more and more into interstate commerce and a milk bread legal in one State should be equally legal in another.

The proteins and salts separated in the production of butter splendidly balance the proteins, salts, and carbohydrates contained in the wheat. It would greatly increase the nutritive value of bread if all of these solids and salts separated in the production of butter could be used in baking. But in order to do this some terminology must be devised which will point out the increased nutritive value to the consuming public and at the same time not trespass upon what the consumer has a right to expect when the term "milk bread" is used. Skimmed milk solids contain valuable proteins, salts, lactose, and everything that the milk contains except the fat and vitamin A. Animal feeding tests with a bread made with skimmed milk solids would show a decline because of the absence of vitamin A, whereas the addition of butter fat to the diet would change the growth curve into an upward trend.

But when added cost is added to a loaf there must be some way by which the added nutriment can be accurately described to the public and the public brought to pay for the necessarily increased cost.

If the control of milk bread is handled through standards it can be handled by regulation by adding a clause to section 3 of the food and drugs act of June 30, 1906, investing the Secretary of Agriculture with the power to make the necessary rules and regulations with a provision for the proper standards to be applied in the making of milk bread.

[62812]

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U. S. Department of Agriculture.
Abstract No. 215.

WORLD'S DAIRY CONGRESS, 1923.

ABSTRACT.

DIFFICULTIES ENCOUNTERED IN ENFORCING THE PASTEURIZATION REQUIREMENTS IN A LARGE CITY.

By Dr. J. H. SHRADER, Director, and WILLIAM DEW, Assistant, Bureau of Chemistry and Foods, City Health Department, Baltimore, Md.

At the time the present Milk Ordinance of Baltimore, Md., was passed (November, 1917) the delivery of milk was in the hands of about 40 dealers who served the milk by dipping it from the cans and pouring it into the vessel of the customer. Some few plants had begun to apply a so-called pasteurization, but much of this was an abuse which left the milk quite inferior to its original condition.

The pasteurization ordinance requires that milk must be uniformly heated to a temperature of between 142° F. and 150° F. and maintained thereat for 30 minutes, after which, it is to be immediately cooled to 45° F., or under, and held in the plant at a temperature not above 50° F. and delivered at temperatures not above 60° F. All pasteurizing, cooling, and bottle filling equipment is to be sterilized immediately after and before each day's operation. No capping by hand is allowed. No pasteurized milk may be sold after 36 hours from midnight of day of pasteurization. The maximum bacterial limit is 100,000 organisms per cubic centimeter.

An inspection force of 5 men was available to enforce the requirements of this ordinance in the 40 dairies. This comparatively large number of plants made an effective control quite difficult so that it was several years before the enforcement, in a city-wide degree, had reached a satisfactory plane. The early control consisted of taking samples from the mixing vat, the filling machine, bottled samples from the plant, and street samples from the delivery wagons. The bacterial counts were based on the plate method of the American Public Health Association. Difficulty was encountered in impressing most of the dealers with the significance of bacteria, but at the present time they are educated to appreciate the value of such findings. Even though the law requires that recording thermometers be installed on the heating and cooling equipment to serve as a control in the absence of the inspector, much difficulty was encountered when the dairymen

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awakened to the fact that they could so manipulate the clock that they could defeat its purposes. Hand capping was frequently resorted to by the small dairies who claimed that their portable capping machines would get out of order. The effectiveness of pasteurization was greatly minimized by the carelessness of many dealers in washing their bottles. The bacterial count of these ranged from a few hundred to many millions. Much effort was expended in teaching the dairymen that a bottle which was apparently clean was very far from sterile. Next to adherence to the specifications of pasteurization, the greatest single item in causing high bacterial counts was ineffective cooling immediately after pasteurization together with insufficient cooling during storage. Even now, this is one of the greatest causes for high bacterial counts. Probably the next important factor is insufficient cleansing and sterilization of the pasteurizing, cooling, and bottling equipment, both immediately following and immediately prior to pasteurization. The effective exclusion of flies is often difficult, on account of the frequent opening and closing of doors at the dairy, and because of the careless handling of the milk by the wagon drivers.

After five years of enforcement the average bacterial count for the milk, as delivered to the housewife for the year 1922, was 19,400. This represents between 98 and 99 per cent of the milk sold in Baltimore.

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Abstract No. 216.

WORLD'S DAIRY CONGRESS, 1923.

ABSTRACT.

STANDARDIZATION OF THE STERILIZATION OF MILK BOTTLES.

By J. H. SHRADER, Director, and R. S. CRAIG, Assistant Director, Bureau of Chemistry and Food, Health Department, Baltimore, Md.

This investigation was planned to ascertain the conditions which caused a great irregularity in the bacterial counts of milk bottles, which had apparently been washed and sterilized as carefully as could be readily ascertained by ordinary inspection, and also to determine the relative effectiveness of the several types of commercial bottle washing and sterilizing equipment which at the present time are offered to the industry. The equipemt studied varied from the highly developed power-driven hydraulic bottle-washing and sterilizing machines using graduated temperature washes followed by alkaline and steam treatment down to the smallest hand-washing and sterilizing equipment consisting of nothing more than a tank and a brush. A study of about 200 bottles under the most extreme of cold weather conditions wherein the bottles containing incrustations of ice were fed to the machine showed that 96 per cent contained less than 200 bacteria per bottle and that after a 24-hour storage in an inverted position in the cases in the dairies 95 per cent were under 200 bacteria per bottle. A little instruction convinces the dealers that steam can be used effectively when intelligently applied. Alkaline soaking is absolutely necessary as a preliminary treatment to soften up the hardened casein and adhering dirt. On the basis of these findings, which were all effected under industrial conditions and were worked out in typical dairies in the city, it was found that it is perfectly reasonable to require that 4 bottles out of 5 should contain no more that 200 bacteria per bottle, a specification which is likewise applicable to freshly sterilized bottles or to those held after storage.

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U. S. Department of Agriculture.
Abstract No. 217.

WORLD'S DAIRY CONGRESS, 1923.

ABSTRACT.

STERILIZATION OF MILKING MACHINES.

By ROBERT S. BREED and A. H. ROBERTSON, New York Agricultural Experiment Station, Geneva, N. Y.

While milking machines have been tried out experimentally for many years in North America as in other parts of the world, it was not until about 1910 that they really began to attract the attention of the American dairymen. From that time until about 1916 there was an increasingly rapid introduction of machines on dairy farms which reached a climax in 1917 and 1918 when war conditions caused an acute shortage of labor. With the return of the American Army to civilian pursuits and the necessary readjustment of business following these years there was a sudden dropping off of sales and many users discarded their machines. However, if one may judge from the number of machines exhibited at the present National Dairy Show, as well as from conditions observed in the field, the dairymen are again buying machines. This is apparently due to the increase in price and growing scarcity of satisfactory labor, a condition which forces the introduction of labor-saving machinery. To-day milking machines are found in common use in all of the dairy sections of the United States and Canada. A little thought will show that where machines have been in use on dairy farms for as many years as they have been in America they must be capable of giving good service in the hands of intelligent operators. Under American conditions, the dairymen would never continue to use machines if they caused a diminution in the milk flow or caused injury to the udders.

Perhaps the one thing which has most greatly influenced the development of milkers in North America has been the almost universal insistence of public health workers that market milk be so cared for that it has a low bacterial count. This has caused

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extensive investigations of convenient methods of sterilizing milkers. It is the purpose of this paper to discuss the results of these investigations in the light of the practical experience of American dairymen, and in particular those of New York State.

The most natural thought in connection with the cleaning of any dairy utensil is that of scrubbing it, following this procedure by scalding with hot water or sterilizing with steam, and completing the cleaning process by drying. From this has been developed a method of sterilizing the tubes in hot water or steam which, within certain limitations, has been found practical under farm conditions. Largely because of the ease with which rubber is injured by this method of sterilization many attempts have been made to sterilize the tubes with various common and cheap nonpoisonous preservatives or sterilizing agencies, such as brines, hypochlorides and chloramines. The use of each of these sterilizing agencies under practical field conditions has developed certain limitations for each of them which differ according to their chemical properties. All of the substances mentioned, however, have been found so useful that they are used extensively.

Fortunately no one of the methods of sterilization thus far used is successful unless the dairyman keeps the milker parts really clean. For this and other reasons, there seems to be no real ground for opposition to the use of chemical sterilization for this type of dairy utensil where rubber parts must be used.

Inasmuch as the limitations of the successful methods of sterilization are now well understood, the time is right for an increase in the activity of the educational agencies whose duty it is to carry the information to the owner of the machines. The chief handicap in getting prompt acceptance of really satisfactory methods of sterilizing milking machines has been the fact that the dairyman could and still can, usually, dispose of milk drawn through an improperly cleaned machine for as good a price as milk drawn through a clean machine. The thing that is most needed is the development of a fairer and more effective milk inspection. Such an inspection can only be accomplished by basing the control on results obtained from proper laboratory examination of milk.

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U. S. Department of Agriculture.
Abstract No. 218.

WORLD'S DAIRY CONGRESS, 1923.

ABSTRACT.

THE DEVELOPMENT OF THE DAIRY SHORTHORN IN ENGLAND, AND THE INFLUENCE OF THE BREED ON BRITISH AGRICULTURE.

By Maj. GERALD J. BUXTON, Council of the Dairy Shorthorn Association, Tockenham Manor, Wootton Bassett, England.

The paper describes how the milking shorthorn has developed in England and become a part of the English system of agriculture. It is shown that the institution of the Dairy Shorthorn Association was due indirectly to certain developments in North and South America. The efforts of the association were first directed toward curtailing the tendency that had grown up to develop the shorthorn on the lines of beef alone, to the detriment of the deep milking qualities of the breed. Competitions were started at the royal and the leading county shows for pedigree shorthorns of good milking type. The minimum milk yield to enable a cow to qualify for a prize was gradually increased year by year, and the association saw a steady improvement, both in quality and quantity of milk. In 1917 the principle of grading up was adopted, and a register was established of dairy cows of shorthorn type, with authentic milk records. For the foundation cows the qualification was shorthorn type and a milk yield of 8,000 pounds of milk in any one year, or not less than 6,500 pounds per annum over an average of two or more consecutive years. In the yearbook for 1921 there were published 2,497 milk yields, and there were 272 cows recorded that had given 1,000 gallons or over. To-day there are three cows that have given 2,000 gallons and an Australian cow of the dairy shorthorn breed has produced just under 30,000 pounds of milk, and 1,316 pounds of butter fat. The paper concludes with a discussion of the value of stock rearing and arable farming in England at the present time, and suggests that in America, also, with her great increasing population, mixed farming may become more popular, and that under suitable conditions the dairy shorthorn should respond well to the needs of American farmers.

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WORLD'S DAIRY CONGRESS 1923

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U. S. Department of Agriculture.
Abstract No. 219.

WORLD'S DAIRY CONGRESS, 1923.

ABSTRACT.

MILK YIELDS AND ASSOCIATED FACTORS.

By Dr. J. F. TOCHER, Lecturer on Statistics, University of Aberdeen, and Consulting Chemist to the Highland and Agricultural Society of Scotland.

Milk recording in Scotland.—Particulars of the milk yield of 275,814 cows in Scotland have been systematically recorded from 1903 up to the end of the year 1921 and the results collated. From the records kept, particulars are given for each cow of the breed, age, total yield of milk in gallons, percentage of butter fat, yield in gallons at 1 per cent butter fat, period in milk, together with dates of calving.

In addition, calculations have been made by the writer to show the number of gallons per week and the number of pounds of butter fat per week given by each cow. For the purposes of these records the Scottish Milk Records Association classified animals into a number of classes and these and the methods adopted for calculating the percentage of butter fat, etc., are described.

Records of the year 1912.—An analysis of the records for the year 1912 has been made showing the percentage of cows calving during each month of the year, the average yield, and the variations which took place in yield and average percentage of butter fat, according to the month of calving. From the further particulars given it will be seen that the greatest percentage of good cows calved in the month of March.

A table is given showing the average values for cows calving in the three 4-monthly periods, the highest average yield being from cows which calved within the four months August to November, inclusive, due to the longer average duration of the lactation period of this group. A further table shows the results according to the association's classes of cows. The average yields of butter fat to be expected from cows of various ages and various durations of lactation period are shown graphically.

Records of the year 1920.—An analysis of the records for the year 1920 has been made and for this purpose 21,450 returns were collated. These include records of animals of the Ayrshire, British Friesian, Aberdeen Angus, and Irish breeds, and Shorthorn crosses. In all, 5,320 heifers and 16,130 cows of all breeds were dealt with; yield of

62285—23

milk and yield of butter fat per week were both calculated for each cow. In addition, the average yield of milk in gallons, the average age, the average percentage of butter fat, the average number of weeks in milk, the average total yield of butter fat in pounds, the average yield of butter fat per week, and the average yield of milk per week were all calculated for 14,416 cows of the Ayrshire breed. Results have been tabulated and diagrams prepared showing the results of these calculations.

The variation in milk yield during a lactation period.—As the Scottish Milk Records Association determines at stated intervals the yield of milk per day for each cow, it has been possible to note the change in yield of milk during a lactation period. Calculations were made for a number of cows which had calved in the same month and the variations during the lactation period noted. A comparison is made between these records and the results of private tests.

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U. S. Department of Agriculture.
Abstract No. 221.

WORLD'S DAIRY CONGRESS, 1923.

ABSTRACT.

THE SELECTION OF THE COW BY CONFORMATION.

By GEO. C. HUMPHREY, University of Wisconsin, Madison, Wis.

Profitable dairy cows are highly artificial in contrast with the natural and the average cow of the bovine race. Their production under present-day conditions when milk must be produced in large and economical quantities demands a rigorous selection at all times based on intelligent and painstaking methods.

Conformation is only one of the indexes of merit on the part of a dairy cow. The peculiarity of the parts of the body of the dairy cow bear a relationship to one another and to her functional activities in a manner to correlate conformation with milk-production capacity. Dairy conformation and the inherent milk-production tendencies in improved dairy breeds of cattle have become pronounced and definite to the extent that they may be quite readily recognized.

The high regard for beauty and the desirability of suitable size, age, health, vigor, and disposition, as well as the undesirability of blemishes and abnormal characters in cattle, attach a high degree of importance to a careful study of conformation in choosing cows for dairy purposes.

The value of the milk scale and butter-fat tester can not be overestimated as a means of selection in building the most profitable herds. A milk record, even for only seven days, has been found to be two and one-half times as good an indication of a cow's ability to produce milk as any of the physical parts or combination of parts of her conformation. It is true, nevertheless, that there are a vast number of instances in which dairymen must depend upon conformation in the selection of cows and in no instance can one afford to select and build a herd without regard for it. Keen powers of observation and judgment, combined with knowledge of the parts and characteristics of an ideal dairy cow, render one proficient in the selection of cows by conformation.

The contrast between well-developed and efficient types of beef and dairy cattle, respectively, forms a good basis for the study of selection of dairy cows by conformation. In the case of underfed, poorly developed cattle, conformation is of comparatively little value

in the determination of merit. Under such conditions chance judgment, pedigree, or record of production will have to serve.

Dairy cattle tend to be triangular or wedge-shape in outline, while beef cattle tend to be rectangular. The wedge-shape outline is significant in that the base end of the wedgelike body indicates roomy feed or body capacity and large udder capacity, while the sharp end in the region of the withers and neck reveals an absence of flesh development, indicative of dairy temperament or the disposition to convert feed into milk rather than beef. Feed capacity and dairy temperament are two of the important characteristics of a dairy cow.

Well-developed milk organs, including the udder and mammary veins, are a highly essential characteristic of good dairy cows. Good size and quality are most important considerations in judging the udder. Such udders with uniformly well-developed quarters and with teats of convenient size are most ideal. The mammary or "milk veins" should be prominent and tortuous and carry well forward to wells or openings through the wall of the under side of the body. The appearance of veins over the udder and on the face of the cow are further evidences of a strong circulatory system of blood important to milk secretion.

Evidences of impaired health and low vitality by a narrow condition of the head and body, small nostrils, contracted, listless eyes, a harsh, dry, stiff or papery hide, and a staring coat, detract materially from the milk productive capacity of a cow. There should be evidence of perfect health and vigor.

Style and beauty of outline in the dairy cow please the eye of the owner and the buyer and have a monetary value. Such qualities may not affect milk production, but are worth while to consider in building a herd.

Men who own the most successful dairy herds are keen observers and good judges of cows by conformation. They appreciate records of production to know most accurately the milk production of their cows, but would not divorce judgment by conformation in building their herds.

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U. S. Department of Agriculture.
Abstract No. 222.

WORLD'S DAIRY CONGRESS, 1923.

ABSTRACT.

THE PROBLEM OF BREEDING FOR PRODUCTION.

By R. R. GRAVES, Dairy Division, Bureau of Animal Industry, U. S. Department of Agriculture.

Pure-bred dairy cattle are not transmitting producing ability of 600 pounds butter fat, and more, with as much certainty as they transmit their respective breed characteristics and type. The average range in milk production between the lowest and highest producing daughters of 23 sires was almost 9,000 pounds. Breeders have used several methods of selecting breeding animals. Selection on the basis of type alone; selection on the basis of records of production and pedigree; selection on the basis of type and production; and selection on the basis of family or relationship. What are these various methods of selection accomplishing in the improvement of dairy cattle so that they will be pure for high production?

For years we have taught in judging classes that a large heart girth was indicative of a large heart and lungs and that a large heart and lungs are essential in the great producing cow. Do we really have facts on which to base these teachings? The dairy division is now working on the problem of the relation between outward measurements of animals and the size of the corresponding organs, and the relation of the size of these vital organs to producing capacity.

Selection on the basis of production records of dams alone does not lead to the rapid progress we would like, because the production record of a cow probably does not indicate fully what her germinal make up, in respect to producing ability, may be. If there is a definite relationship between the outward development of an animal and the size of its corresponding organs, and between the size of these organs and the producing capacity, then it would seem that we could eliminate animals whose defects in conformation indicated that they would not be able to make use of an inheritance for large production. On the other hand it seems improbable that conformation will indicate what the inheritance for production ability may be.

Whether the mating of related animals will get better results than the mating of equally good unrelated animals within a breed is dependent upon whether it is the same factors, or the same grouping

of factors, that enables the two unrelated strains to have great producing capacity. It is thought that the most rapid progress in breeding dairy cattle that will be pure for high production, will come through the continuous use of sires that have proven by the uniform excellence in producing ability of their daughters, that their germinal factors controlling production capacity are pure for the factors that will determine high production.

[62790]

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ABSTRACT.

THE WISCONSIN EXPERIMENT IN CROSSBREEDING CATTLE.

By LEON J. COLE, University of Wisconsin, Madison, Wis.

This experiment, begun in 1912, has as its primary object the study of the inheritance of the genetic factors concerned in milk and meat production in cattle, and incidentally, any other characters that lend themselves to genetic analysis. Some of these latter, such as color, character of the horns, and the like, are fairly definitely fixed within breeds, but there is great variability with respect to conformation and milk production even in the most specialized breeds. In a genetic study, therefore, it seemed advisable to choose animals for the original crosses differing as greatly as possible in these characters, thus exaggerating the differences which could be found in any single breed and making them easier to follow in subsequent generations. Correlations in the second-generation offspring should give some indication as to the extent to which certain characters are necessarily associated (either from genetic or direct physiologic causes) and to what extent they may occur independently.

Aberdeen-Angus and Jerseys were chosen originally as the breeds to be crossed, they being considered representative of the highest refinement of breeding for beef production and for dairy purposes, respectively. Change has since been made, however, to an Aberdeen-Angus by Holstein-Friesian cross as giving greater difference in size, milk production, and per cent of fat in the milk.

Owing to the relatively large expense of an experiment of this kind and the limitation of funds, it has been possible to conduct it only on what would be for smaller animals a very small scale. It was a pioneer work, and one purpose was to demonstrate the value and, indeed, necessity of this sort of investigation in order to make possible the full application of genetic principles to cattle breeding. In the Angus-Jersey cross 12 first-generation offspring have been obtained—5 from Jersey dam by Angus sire and 7 from Angus dam and Jersey sire. In all cases these are black and polled, showing the dominance of these characters of the Angus. Considerable variability of type and milk-producing ability may probably be traced to variation in the foundation stock. A distinct tendency was evident for the off-

spring to resemble their respective sires more than their dams in these characters, but this may be merely coincidence.

Seventeen second-generation offspring produced by breeding crossbreds together (3 from crossbred heifers bred back to a Jersey bull) show great variability in all respects, as would be expected. The inheritance of true horns is a simple Mendelian matter, and black, as contrasted with brown and other lighter shades, seems also to be simple in inheritance. One of the most striking differences in relation to milk production in the original breeds is the length of the normal lactation period; this and other such characters are too complicated for analysis, however, with such small numbers.

In the Angus-Holstein cross only 13 first-generation offspring have so far been obtained. Here again the black color and the polled condition of the Angus are dominant, though in this cross there is usually more or less white on the feet and a small, white star on the forehead. The males of this cross make quick-growing steers of good size which seems to flesh readily; the milk production of the heifers has not yet been tested.

It should be emphasized that this experiment is a definite attempt to gain scientific data which will be of value in cattle breeding and not an attempt to produce any new type of economic importance.

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U. S. Department of Agriculture.
Abstract No. 224.

WORLD'S DAIRY CONGRESS, 1923.

ABSTRACT.

THE INHERITANCE OF MILK PRODUCTION AND BUTTER-FAT PERCENTAGE.

By JOHN W. GOWEN, Biologist, Maine Agricultural Experiment Station, University of Maine, Orono, Maine.

In their chronological order choice by type, choice by pedigree, and choice by performance have been practiced in selecting cattle to fill up our dairy herds. The purpose of this paper is to review briefly the relative value of these methods for determining milk yield and butter-fat percentage. In his extensive studies on conformation in relation to milk yield, the writer has been able to show that total score, milk veins, rear udder, udder size and texture, body shape, neck, withers, general appearance, teats, rump, and thighs in the order named were, in the hands of the average dairymen, the more important parts of conformation for distinguishing the high milk producing cow from the low milk yielding cow. It was also found that there was a large personal equation for the different judges. It became evident that no such person as an "average dairyman" exists. There were good judges, fair judges and poor judges even among experienced men. It was further shown that the good judges were able to utilize points of conformation of but little or no value to the poor judges in selecting milk yield. Furthermore, even if the best judges are considered, the value of the different points of conformation in indicating milk yield are relatively slight. In fact, a record as short as seven days is about twice as good an indicator of milk yield over the full lactation period as any point or points of conformation. Moreover, it was possible to show that conformation had no relation to the butter-fat percentage in the milk. Thus the facts justify the subordination of type to proved productive worth.

Choice by pedigree is of dubious value in indicating the probable productive capacity of the cow. The grounds for this conclusion are based on the writer's study of the Jersey and Holstein-Friesian record. Five groups of sires were used in this study. These groups of sires were those whose daughters were significantly high in milk yield, significantly low in milk yield, significantly high in butter-

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fat percentage, significantly low in butter-fat percentage and a random sample of the breed with no advanced registry record sons or daughters. These five groups showed no significant difference in inbreeding or relationship in the four generation pedigrees. They showed practically the same ancestors were repeated in all five groups. In other words, the character of the pedigrees in the five groups was much the same both in breeding and in animals contained therein. In view of these facts, pedigree study seems to offer little to aid the breeder in selecting his dairy cows.

In studies of the Jersey and Holstein-Friesian breeds the performance records have been shown to offer a much better means of choosing dairy cattle for milk yield than either of the methods just reviewed. The milk yield of the dam predicts the probable milk yield of her daughters quite accurately. Thus the average milk yield of daughters coming from dams of 12,000 pound milk yield was 16,106 pounds, and those coming from dams of 26,000 pound milk yield was 23,279. The milk yields of the daughters increase as the milk yields of the dams increase. A similar relation exists for the butter-fat percentage contained in the milk; the dam's record has a good deal of value in predicting the butter-fat percentage of the daughters. A cow also indicates the milk yield of her full sister quite accurately. In fact a full sister's record is as good for predicting the milk yield of a cow as the record of the dam of that cow. The same is true for the butter-fat percentage, a cow's butter-fat percentage having a correlation with her full sister's butter-fat percentage equal to the correlation between the butter-fat percentage of daughter and dam. In a similar way, the great disadvantage of not having a record on the sire may in part be obviated by a record on the full sister since the relation between the butter-fat percentage of full sisters is as great as it would be between the butter-fat percentage of sire and daughter, were it possible to measure directly the butter-fat test of the sire.

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ABSTRACT.

PROTOZOAN DISEASES OF DAIRY CATTLE.

By Sir ARNOLD THEILER, K. C. M. G., Director of Veterinary Education and Research for the Union of South Africa; Professor Pathology in the Veterinary Faculty of the Transvaal University College, Pretoria, South Africa.

The writer explains that his experience was gained in South Africa, a country in which protozoan diseases are of enormous economic importance. *Trypanosomoses*, *Piroplasmosis*, *Anaplasmosis*, *Spirochaetosis*, *Sarcosporidiosis*, *Coccidiosis*, are discussed, and a disease, "Heartwater," caused by an ultravisible virus, is included on epizootological grounds.

On account of their general geographical distribution these protozoonoses are referred to as tropical and subtropical. It is suggested that they were originally characteristic of the Old World, thence spreading into the new one, but disappearing wherever intensive cultivation is practiced. One peculiarity common to protozoonoses is the necessity for an intermediary invertebrate host, the dependence of which upon favorable climatic conditions explains the persistence of the diseases in warm countries. Another peculiarity is that animals may act as reservoirs of the virus after they have recovered from the disease, and apparently healthy cattle may therefore spread the infection if imported into any clean country which happens to possess the invertebrate hosts. A third peculiarity is that the most formidable protozoonoses are blood diseases, and therefore transmissible by mechanical methods.

The various trypanosomoses are then discussed according to their mode of transmission. *T. brucei* and *dimorphon* represent a group transmitted by the genus Glossina. *T. evansi* represents the type mechanically transmissible by any biting fly, and for which no specific invertebrate host is required. *T. vivax* represents a group which has an obligatory intermediate host in Glossina, but which may also be mechanically transmitted by a number of different flies. A fourth group, generally treated as nonpathogenic, is represented by *T. theileri*.

The problem of eradication is generally associated with the extermination of the winged vectors, but recently some progress has been made with drug treatment (Bayer 205 and tar emetic). Trypa-

nosomes requiring Glossina as intermediate host are only of practical importance in Africa, but those requiring no such host are a constant menace to all importing countries which contain blood-sucking flies. Treatment with drugs capable of sterlizing the blood, combined with destruction of drug-resistant individuals, is suggested as a promising method of dealing with this menace.

The tick-borne diseases are then considered. The parasites belong to the *Babesidae*, *Anaplasmidae* and *Spirochaetae*, but also include an ultravisible virus. The author considers that the parasitic nature of Anaplasms must now be admitted. Two classes of tick-borne diseases are distinguished; one in which the recovered animal acts as a reservoir and therefore menaces all importing countries possessing ticks; the other in which only the sick animal harbors the infection. Both classes are best dealt with by eradicating the ticks. Systematic dipping in arsenical baths, at strengths and intervals based upon the life history of the particular tick, has proved the most successful method in South Africa. Other means of fighting tick-borne diseases are mentioned, but regarded merely as palliative measures. The various modes of transmission are discussed.

Sarcosporidiosis is treated as of little practical importance. Transmission is probably due to intermediary hosts accidentally ingested by the cattle.

Coccidiosis is treated as a fourth group, occurring all over the world, but only of localized importance. It is suggested that coccidia are propagated through an invertebrate, and only incidentally cause disease.

Control of protozoan diseases primarily concerns the State. Interstate movement of possible virus reservoirs should be restricted. Destruction of intermediary hosts and permanent reservoirs should be undertaken. Protozoan diseases will probably disappear with increasing intensity of cultivation.

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ABSTRACT.

DISEASES OF THE DIGESTIVE SYSTEM OF CATTLE.

By D. H. UDALL, Cornell University, Ithaca, N. Y.

The introduction explains the relative importance of the digestive system as a seat of disease, as a portal of entry for the causes of disease, and as a source of distribution of infection. This paper deals largely with the etiology, occurrence, and prevention of disease.

INDIGESTIONS.

Indigestion is a derangement of the normal functions of the stomach and intestines. Severe forms lead to severe local inflammations, and fatal general intoxications.

Among calves it is often the fundamental cause of so-called white scours. When calves are properly fed and protected, septicemia of the new-born is relatively mild. The following method of care and feeding is suggested:

1. Allow the calf to remain with its dam for the first 12 hours. This provides colostrum, but does not permit overeating.

2. On the second day, withhold all milk unless the calf shows evidence of great hunger, when it may receive 8 ounces each of dam's milk and lime water at body temperature.

3. On the third day, feed 4 to 5 per cent of the body weight of the dam's milk. This should be mixed with an equal amount of lime water and heated to 100° F.

4. At the end of the first week the calf may receive 8 to 12 per cent of its body weight of milk. At the end of the second week this may be raised to 10 to 14 per cent, of the body weight. Feed morning, noon, and night, each feed containing a pound of lime water. Warm the milk to 100° F. and feed in individual pails. After feeding, rinse the pail in clean water, and scald it in steam under pressure, or boil a small amount of water in it for two to five minutes. During the first week, before the noon feed, take the temperature. If it is 103° F., or more, give an enema and 3 ounces of liquid petrolatum. Withhold feed until the temperature is normal and the calf is ravenously hungry. At birth give 3 ounces of liquid petrolatum

to a 70-pound calf. Housing conditions should protect calves against extreme cold, sudden changes in temperature, and cold drafts.

Indigestion in cows is the most frequent primary disease of the alimentary tract. The mortality is low. Fatalities occur chiefly in herds of poor or careless owners. Their animals more readily gain access to grain bins, frozen grass, newly threshed grain, fields of luxurient roughage, heated or moldy fresh silage or hay, spoiled food, etc. Most indigestions occur in seasons when the food is changed from an old to a new crop. Prevention is easy. Herd managers who provide a reasonable variety of dry and succulent roughage, as well as grain, and who feed regularly, have little to fear from this disease. Affected cows should be deprived of all food for 24 to 48 hours and given a laxative.

TRAUMATIC GASTRITIS.

Pointed metal objects, such as wires, small nails, or pins, are often swallowed by cattle. Among all affections of the digestive system, traumatic injuries from such objects cause the greatest loss. Often the resultant inflammation spreads during advanced pregnancy, or following parturition. The loss from traumatic gastritis is not measured alone by the deaths of which it is the direct cause, though these place it well at the head of the list of digestive fatalities. Often a cow that appears to have died of some other disease, is found on autopsy to be also affected with traumatic inflammation. She might have survived either disease singly, but the combination proved fatal.

Prevention.—Where baled hay is fed, the wire should be removed from the premises. The same holds true of wires attached to grain sacks. Pastures inclosed with woven-wire fence are especially dangerous when the wire disintegrates. Keep cattle at a distance from buildings under repair.

INFLAMMATION OF THE STOMACH AND INTESTINES.

This includes a description of nonspecific inflammations, most of which are dietetic in origin, and specific inflammations, such as Johne's disease, coccidiosis, etc.

The final section deals with the general problem of how to prevent the entrance of infection into the digestive tract. It includes causes additional to those attacking the digestive organs.

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ABSTRACT.

BOVINE MASTITIS.

By F. S. JONES, V. M. D., Rockefeller Institute, Princeton, N. J.

The paper discusses the etiology and symptomatology of the parenchymatous and catarrhal forms of mastitis. Considerable of the literature dealing with the bacteriological findings and other phases of the problem has been reviewed. A summary of the writer's investigations on the etiology and symptoms is included. The observations on the sources of infection in streptococcic mastitis are given in some detail. From them the conclusion is drawn, that aside from clinical cases of mastitis, apparently normal cows may carry mastitis streptococci in the udder. These carriers have been grouped as follows: (*a*) Those that have been recently infected and have not yet developed symptoms, (*b*) those that have suffered from inflammation of the udder and after apparent recovery still harbor the organisms within the udder, and (*c*) certain cows that have had no clinical history of mastitis. In addition, the probable means by which the virus may be disseminated and gain access to the udder have been considered.

Mastitis, aside from its economic aspects, has been of considerable importance to those interested in the public health. Fortunately, streptococci of purely bovine origin have not been shown to be pathogenic for consumers of milk. Some of the more recent findings indicate that the udder may be invaded under certain conditions by human streptococci. These are shed in the milk. Certain well-defined epidemics of septic sore throat have originated in this manner.

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ABSTRACT.

MASTITIS.

By J. N. FROST, Professor of Surgery, New York State Veterinary College, Cornell University, Ithaca, N. Y.

Mastitis is an inflammation of the udder which is made up of a glandular or secreting part surrounded by a framework of interstitial tissue containing the lymph and blood vessels.

The principal cause is infection, with other causes acting as predisposing factors. High protein feed, cold floors, and bagging up, by lowering the resistance of the udder give the infection a better chance for development.

The infection may enter through the teat canal, the blood stream, or a wound or abrasion of the skin of the udder.

The source of the infection is most likely from the genital tract, filthy paddock, dirty stable floor, or the discharge from a skin lesion of the udder.

Symptoms.—Mastitis may occur at any age from the young calf to the aged cow and at any period, whether dry or milking.

The first symptoms in the acute form of mastitis are chills, staring coat, increased pulse, respiration and temperature, lameness, swelling, heat and pain in the udder.

The changes in the milk vary from clots of casein and blood to a thin watery secretion of a yellow or reddish tinge.

Sequellæ.—As an after result of mastitis, we may have a narrowing or complete closure of the teat canal, either a thickening or shrinking of the udder and possibly abscess formation. It may also result in general disease of the brain, lungs, joints and tendons, or abscess formation in any of the internal organs.

Prevention.—Provide a clean, disinfected stall at time of calving.

Keep the hind parts washed thoroughly after calving to prevent discharges from running down over the udder.

Confine the milking cow in a well-bedded stall with platform of sufficient length and partition between stalls. The Hoard modified stall serves very well to keep the udder clean and free from injury.

Milk the first few streams into a screen covered utensil.

Milk the udder out thoroughly, if necessary making it a special task to go over the herd the second time.

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Isolate all cases of mastitis as much as possible.

Milk from a diseased quarter should be drawn into a pail of antiseptic instead of on the floor.

Dip the teats in antiseptic solution after milking.

Drying-off process should be thorough to prevent mastitis of the dry cow.

Protein diet should not be increased too rapidly.

Prevent mates from sucking the udders of heifer calves.

Cows with uterine discharges should not be allowed in milking stable.

Stalls should receive thorough disinfection after the removal of a case of mastitis.

Bacterins made from cases of mastitis in same herd are of benefit in prevention where value of animal warrants their use.

Treatment.—Begin treatment as early as possible.

Diet should be restricted to one of low protein ration and gradually increased.

The general line of treatment is a physic, dieuretic, hot or cold applications, massage, frequent milking, suspensory bandages, antiseptics, bacterins, and vaccines.

Antiseptics may be used in three ways—first, and most important, by elimination through the milk; second, by injection into the milk cistern; third, by external application.

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ABSTRACT.

INVESTIGATIONS ON THE PATHOLOGY OF STREPTOCOCCUS MASTITIS AND ON THE EVENTUAL TRANSMISSION OF MASTITIS THROUGH MILKING MACHINES.

By Dr. O. STENSTRÖM, Professor of Pathological Anatomy, Royal Veterinary College, Stockholm, Sweden.

The purpose of the experiments described in this paper was to answer the question "Have milking machines any influence on the occurrence and spread of garget?"

The investigations were limited to streptococcus mastitis, that form of garget generally supposed to occur in connection with machine milking. The subjects used were scrub or grade cattle. The cattle were milked twice daily and the milk was examined twice a week, bacteriologically, by plate cultures on serum agar.

The first test group included five cows just freshened and two cows with malignant streptococcic mastitis. These latter were milked twice daily by machines and the machines were immediately afterwards applied to the five cows with healthy udders. No infection resulted in the healthy cows nor could infection be demonstrated after milking the cows with teat cups that had been immersed in milk from the infected cows.

Three cows approaching the end of the lactation period and three others suffering from streptococcic mastitis were the animals of the second test group. In addition to milking with teat cups that had been filled with streptococcus milk, scarifications were made in the teat ducts of the healthy cows. After eight weeks of this treatment no infection could be demonstrated in the healthy cows.

In the third test group, two cows, just freshened, were milked with teat cups filled with milk from two spontaneous cases of streptococcic mastitis and one induced case. One of the cases was also given streptococcus milk *per os*. In a short time this latter subject developed a clear, clinical case of garget, but the other cow, which was exposed only through the milking machine, remained immune. Indeed, no infection appeared in this cow even when she was later fed streptococcus milk.

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Milk from an infected herd was used in a trial to infect a third cow. After filling the teat cups with this milk and milking the test cow twice daily for six weeks no infection developed. This cow was not immune as she was later infected by injecting a broth culture of streptococci into the udder.

In the fourth series of experiments we tried to discover the factors that must come into play in order that virus might occasion an outbreak of garget. Five cows, just freshened, were used as subjects.

One test animal was first milked by hand and fed streptococcus milk *per os*. After some days streptococci appeared on the plates but later disappeared. This cow maintained an immunity even when infected teat cups were used and infected milk was still fed. An intravenous injection of 100 c. c. of streptococcus culture in ascitis broth also failed to infect.

Another cow, with some variations in the above treatment, did not demonstrate an infection until injected with streptococcus milk through the teat duct.

Weak resistance was also demonstrated in a newly freshened cow suffering from catarrh of the udder. For a period during which the experiments were suspended, the infection subsided but on resuming the tests a severe case of mastitis was indicated.

Of the two remaining cows, both were fed streptococcus milk. The first cow gave a slight streptococcus indication but failed to develop garget. Injection of 100 c. c. of streptococcus milk into one teat caused a mild inflammation which later subsided. The other cow, machine milked but not milked overtime did not develop garget but did become infected when milked for 15 minutes overtime.

It may be concluded from the results of these experiments that (1) it is impossible to produce garget by means of milking machines used on healthy cows after freshening or in the later stages of lactation, even though the conditions are made far more unfavorable than would be found in practice; (2) in reality, infection by milk plays no part in occurrences of streptococcic mastitis; (3) streptococci pass into the udder from the alimentary canal; (4) streptococci may be present in the udder without being demonstrable in the centrifuge sediment and cows may thus, as carriers, spread the infection; (5) these experiments did not show any influence of breed on the occurrence of the disease.

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ABSTRACT.

STERILITY IN DAIRY CATTLE.

By W. L. BOYD, Professor of Veterinary Medicine, University of Minnesota.

This is a brief summary of information on sterility in cattle. Sterility is defined as the inability to produce young. It may occur in either the male or female, but the most damaging effects are produced when the female is no longer capable of reproducing her kind. Sterility is one of the chief phenomena or sequelæ of bovine infectious abortion. It is stated that the *Bacterium abortus* Bang is probably not responsible for many of the pathologic changes occurring in sterility, yet it frequently paves the way for other microorganisms, particularly those belonging to the pus-producing group. Staphylococci, streptococci, the bacillus pyogenes, and certain members of the colon group are the ones most often encountered. Sterility is said to be one of the most important diseases affecting the cattle-raising industry, and with the rapid increase of pure-bred cattle its economic importance is becoming enormous. Many cows, representing years of careful constructive breeding, become incurably sterile, and when they are no longer capable of reproducing themselves, they must be sold for beef prices.

Sterility in the male animal is discussed briefly. It is stated that the continued employment of aged, though proven sires, is good constructive breeding, but must be judiciously performed or many cows with healthy reproductive organs will be found not to be in calf, on account of having been mated with a sterile sire.

The relation of diet to reproduction is briefly mentioned, in which the author says that many of the cattle breeders of this country are, in addition to their regular feeds, adding certain minerals in the attempt to control their losses from infectious abortion and sterility. While the absence of vitamines and minerals in the diet of cows may play an important rôle in the different types of sterility, more experimental work is necessary before these questions can be satisfactorily answered. Retention of the fetal membranes is given as one of the important symptoms of abortion disease, and it is a frequent forerunner of sterility. Retention of the fetal membrane is a very serious condition and demands very careful and prompt attention in order to prevent failure of the cow to get with calf. Treatment of

cows affected with retained afterbirth should be attempted only by the veterinarian. The corpus luteum, which becomes pathological, and thereby interferes with estrum and ovulation, will as a rule within a few days following its removal bring about the well-known signs of estrum. It is thought that the persistent corpus luteum interferes with estrum and ovulation by mechanical obstruction and by some internal secretion.

Pyometra is said to be a condition of the uterus, in which there is an accumulation of pus, causing the organ to become sacculated with loss of muscle tone, and inflammation and dilitation of the cervix. This condition frequently, though not always, results from retention of the fetal membrances. The bacillus pyogenes has frequently been found in these cases. Pyometra is also characterized by retention of the corpus luteum and absence of estrum.

In diseases of the ovaries, cystic changes, in which the ovaries become filled with waterylike fluid, is the most common disease of these organs. Degeneration of the ovaries may be quite rapid, but when these cases are successfully treated, the changes characterizing regeneration are almost, if not equally, rapid. The chief symptom of extensive cystic changes of the ovaries is nymphomania (chronic buller).

Cystic ovaries are commonly found in aborting cows, also cows that have never aborted, and occasionally in young unbred heifers. The etiology is unknown and the origin of the cysts is not clearly understood, yet they are known to originate both from the Graafian follicle and from the corpus luteum, especially in the persistent corpus luteum.

Diseases of the cervical canal and uterine tubes are said to be very important and are of frequent occurrence. Diseases of the vagina are not uncommon, but they seldom produce changes which result in incurable or permanent sterility. Specific infections of the genital organs, such as tuberculosis and actinomycosis, tumor formations, and congenital defects, are mentioned as important factors in the study of sterility, but lack of space prevents a discussion of the same.

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ABSTRACT.

THE PRESENT STATUS OF OUR KNOWLEDGE OF ABORTION DISEASES.

By C. P. FITCH, Chief of Division of Veterinary Medicine, University of Minnesota, University Farm, St. Paul, Minn.

Abortion as a disease among animals has been known for many years. It is recently, however, that its importance has been appreciated and that it has been carefully studied. Bang discovered the cause in 1897. Since that time many have contributed to our knowledge of the germ. With the methods now in use, it is quite easy to cultivate.

Abortion is but one symptom of the disease. This has been the cause of considerable confusion. Other germs, restricted rations, drugs, mechanical injuries, and yet unknown causes may induce abortion. After everything has been taken into consideration, however, the only kind of abortion which is widespread and common is that due to the Bang organism. *Bact. abortus* has not been found in nature except in the infected animal or material, contaminated by discharges from the same. In the cow it is found in the pregnant uterus, udder, and their regional lymph nodes. It is found in the aborted fetus and sexual organs of the bull. The Bang germ is closely related biologically to *B. melitensis*, the cause of malta fever. Animals may become infected by the abortion germ, taken in with the food or through the genital tract. The most common way is through the digestive tract. Further investigation of this phase is necessary. The most susceptible age for infection is at the time of sexual maturity. The germ is eliminated from the body of the infected female through milk, uterine discharges, fetal membranes, and aborted fetuses; from the bull in the seminal fluid and urethral discharges. Abortions may occur at any time during pregnancy. The disease produced by *Bact. abortus* in the cow is largely limited to the chorion and the fetal and maternal cotyledons, and in the bull is usually manifested by abscessation of the testacles or seminal vesicles. The chorionic epithelium, in particular, is invaded by the abortion germ. The changes produced in the udder are usually not macroscopically visible. Bovine infectious abortion can be diagnosed by

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means of the herd history and the blood tests. One is not justified in making a diagnosis of abortion disease until the germ has been isolated or the blood test has been used. Abortions are not all due to a single cause. Complications of abortion are frequent and include inflammation of various parts of the generative tract of cows and bulls. The common causes of the inflammation are the pyogenic bacteria, which may or may not be preceded by infection with the Bang organism.

Knowledge is one of the first essentials in the successful control of an infectious disease. This knowledge must be widely disseminated and fully understood by the owners of cattle. The seriousness of the disease must be fully understood by the cattle-owning public before successful control measures can be instituted. The World's Dairy Congress can do much to aid in making available the necessary information concerning abortion. We should not wait longer for some drug or vaccine which will render the control of the disease comparatively easy.

Three classes of herds present themselves for consideration: (1) The clean herd; (2) the slightly infected herd; (3) the badly infected herd. The procedures vary according to the conditions existing on the particular farm. It is possible to keep a herd clean by means of quarantine and the blood tests. A clean herd can be raised up from an infected one by keeping the heifers and bulls separate. Badly infected herds of grade animals should be sold for immediate slaughter. Living vaccines will reduce the number of abortions occurring in a herd. These products are still in their experimental stage. Police measures should be instituted to prevent the sale of recent aborters.

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ABSTRACT.

OSTEOMALACIA AND ITS OCCURRENCE IN CATTLE IN NORWAY.

By PER TUFF, Professor in Norwegian Agricultural College, Aas, Norway.

Osteomalacia in cattle occurs frequently and plays a large economical part in Norway.

Among the various causes, insufficient supply of minerals through the fodder is the most frequent one.

This is most often due to the following circumstances:

1. Insufficient quantities of lime and phosphoric acid in the soil (osteomalacious districts).

2. The plants absorb too little mineral salt owing to heavy drought during the period of growth. After a heavy drought the bone brittleness appears frequently.

An essential displacement of the natural mutual quantitative proportion between the inorganic salts in the fodder will predispose to osteomalacia.

Various symptoms accompanying osteomalacia may be explained as a weakened function of the various organs because of loss of calcium and phosphoric acid.

Treatment must be adjusted according to causes. Generally after a heavy drought there is insufficient phosphoric acid. Then the use of Phosphas natricus is favorable. In the use of hay from marshes and forests both phosphoric acid and calcium are generally lacking. In that case, phosphate of calcium, bone meal, or fish meal should be used.

Preventive treatment is, however, the most important. Systematic investigations should therefore be undertaken to decide the causes in osteomalacious districts. Such investigations should include inter alia a quantitative analysis of the inorganic salts in the soil and vegetation, also a botanical survey of the chief plants. Pastures which have been observed to cause osteomalacia should be fertilized with the mineral manure substances lacking. More especially, measures should be taken in districts where experience has taught that osteomalacia follows periods of drought.

In indoor feeding care should be taken when mixing the fodder that it contains sufficient lime and phosphoric acid in the correct mutual proportions. Cows which produce much milk should always receive additional lime and phosphoric acid. They should also have a dry period sufficiently long for them to store up the necessary quantity of mineral substances.

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ABSTRACT.

BOVINE TUBERCULOSIS CONTROL.

By VERANUS A. MOORE, New York State Veterinary College, Cornell University, Ithaca, N. Y.

Bovine tuberculosis was brought to the United States by importing infected cattle. At first its dissemination was slow, but with increase in cattle traffic, it became widespread. The practice followed by many dairymen of selling dry cows and buying fresh ones, together with the feeding of calves with separated milk from creameries and whey from cheese factories, accelerated its spread from one herd to another. The adoption of common mangers and watering troughs added very much to its dissemination in the herds already containing diseased animals.

The control of bovine tuberculosis in the United States began under the impression that much human tuberculosis was of bovine origin. In some States large appropriations were made for testing dairy cattle, destroying the reactors, and indemnifying the owners for the same. The method of control adopted for the greater part in the States was the tuberculin testing and slaughter procedure. The conservative method followed in Denmark, and known as the Bang method, has been followed officially to a very limited degree. However, it has been used by many individual owners with marked success. In 1917 the accredited-herd plan was proposed by the United States Bureau of Animal Industry. In cooperation with the States, it has made rapid progress. It consists in making free tuberculin tests; removing, usually by slaughter, all animals that react; cleaning and disinfecting the stables; permitting only tested cattle to be introduced into the herd; making subsequent tests until there are two annual or three semiannual tests without a reactor in the herd, when it is accredited. The Federal Government allows an indemnity of $50 for each pure-bred animal and $25 for each grade animal in addition to the amount paid by the State when the total does not exceed the appraised value. In March, 1923, there were 25,136 herds accredited and 271,023 herds that had passed one negative test.

The control of bovine tuberculosis consists in safeguarding herds that are being assembled, in protecting sound herds, and in eliminating the disease from infected ones. The chronic nature and slow

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development of the disease requires the closest adherence to the knowledge of the nature of the disease. As tuberculin does not give a reaction in a small percentage of infected animals, it often happens that several tests are necessary before all the diseased individuals are found. This fact, coupled with the danger of introducing the infection from without, often renders the eradication of tuberculosis from infected herds a slow process. The essential factors in its control are: (1) The determination of the owner to have a sound herd and to be willing to do his part in securing it; (2) a possession of a general knowledge of the nature of the disease and the means by which it is disseminated; and (3) to have immediately available an adviser or advisers from whom the owner may obtain promptly the technical information he will need from time to time in the management of the herd.

The local veterinarian is the logical adviser to the owner and the teacher of the community on the nature and prevention of disease. The owner can eradicate tuberculosis from his herd without the aid of the State or Federal Government. The time may come when the public will not approve State or Federal assistance for this purpose. Many people believe that owners are largely responsible for having the disease in their dairies. If cattle owners had followed the instructions that have been provided for them during the last 20 years, they would have little or no tuberculosis in their herds to-day. Consumers of milk and dairy products are insisting on obtaining them from healthy cows. Boards of health are passing regulations requiring that all raw milk sold in their jurisdiction should come from tuberculosis-free cows. The present trend indicates that in the near future nontested herds may be quarantined so far as the sale of animals or their products are concerned. The experience of the past has shown clearly that nonreacting animals from infected herds are not safe. The sound herd is the unit to deal with. The control of bovine tuberculosis requires simply an intelligent understanding of the disease in all of its modes of dissemination. Its prevention is much cheaper and easier than its elimination. As yet there is no method for immunizing cattle against tuberculosis that is of practical value. Its prevention, therefore, depends on keeping the infecting organisms away from the cattle. It is important to keep the sound herds free from infection. Economically, one can not afford to have his cattle infected, and consumers should not be asked to use raw milk from tuberculous herds.

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ABSTRACT.

THE CONTROL OF THE FOOT-AND-MOUTH DISEASE IN EUROPE.

By Dr. R. von OSTERTAG, Ministerial Counselor of the Department of the Interior of Württemberg, Stuttgart, Württemberg.

Among the infectious diseases of dairy cattle the most important one, next to tuberculosis, is undoubtedly the foot-and-mouth disease; for it is transferable to man by the use of milk, and causes the greatest economic damage to dairy husbandry. In addition to this the disease is extremely difficult to eradicate wherever it has once taken root, so that it must be considered as a permanent danger.

Through the investigations made in Europe in connection with the last great epidemic (1918–1921), it has been found that the milk may be infected even before the formation of the well-known blisters in the mouth, on the hoofs, or in the udder has taken place. Children are especially exposed to the danger of the disease, although during the last epidemic in Germany there were serious infections of adults also. Milk becomes harmless by heating to 85° C., or by a single boiling up, or through the natural acidification which occurs in sour whey and buttermilk (Poels and Boersna). In exceptional cases the infection may be transferred to man by the use of butter.

The economic importance of the foot-and-mouth disease results from the reduction of the milk production, from the decrease in the uses to which milk may be put, from the loss of meat, from sterility caused by it, from the danger of infection of pigs, and from the heavy losses of adult animals, in the case of the malignant course of the epidemic, in which the mortality amounts to from 50 to 70 per cent.

The difficulties in combating the disease lie in its easy mode of infection, its liability to be spread not only by infected animals, their products and their excretions, but also by intermediate carriers of various kinds (persons, dogs, fowl, birds, hay, straw, stable implements); in the existence of permanent carriers of germs of the infection, and in the absolutely or relatively short period of immunity of inoculated animals.

The most effective measure for control of the disease is the immediate slaughter of the infected herds, when recently imported into countries or districts that had not yet been infected. This method has been effective in Sweden, the Danish Islands, England, the United States, and Australia. Even though its enforcement may prove expensive, this measure pays in such countries as are pro-

tected by their natural boundaries against constant reintroduction of the epidemic from other lands. Where the infection has taken a firm hold, and one has to reckon with a constant reintroduction from neighboring regions, as happens in most of the European countries, one must, on account of the expense, be content with general veterinary police measures, such as quarantine, restrictions on the transportation of infected and exposed animals and also of intermediate carriers, and careful disinfection during and after an epidemic. Through the strict enforcement of such measures as these the disease can not be eradicated, it is true, but it may be prevented from spreading farther.

For the support of the veterinary police measures, chemotherapy, which has so far been a failure, and protective inoculation, about the prospects of which no definite judgment can be expressed as yet, were tried in Europe.

Protective serum obtained from highly immunized animals may give endangered herds a so-called passive immunity, which lasts only from one to three weeks, but may favorably influence the especially maligant course of the disease. In the malignant course of the disease the use of serum of inoculated animals (blood serum of convalescents) has proved successful in Germany, in Austria, in Switzerland, and in France. This use had already been recommended by various investigators, but only since the last great epidemic in Germany has it been systematically employed according to the Schleissheimer process. In the blood of inoculated animals the protective substances obtained their strongest concentration as early as the seventh day. A more permanent protection, an active immunity, may be secured through the inoculation of protective serum or convalescent serum and foot-and-mouth disease virus (lymph from blisters or blood of animals suffering from fever). At the present time, however, this active immunization has only the value of an emergency inoculation, practicable only in infected herds, because at least some of the animals subjected to it fall sick with inoculated foot-and-mouth disease, and therefore may, like those naturally infected, spread the epidemic.

Two recent discoveries show, namely, that small experimental animals may be infected with the foot-and-mouth disease (Waldemann and Pope), and that cultures of the causative agent may be produced.

The artifical cultivation of the causative agent and the opportunity for mass experiments on guinea pigs improve the prospects for the preparation of a highly effectual, protective serum, and the possibility of producing such a serum and culture that inoculated animals may become immune without falling sick with the formation of blisters. It is also anticipated that a polyvalent vaccine may be prepared which will produce immunity against the various sources of infection.

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